tau-tron

A UNIT OF GENERAL SIGNAL

Model 5108

DS1 Digital Transmission Test Set

Service Manual

February, 1992

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REV	DESCRIPTION		DATE	APPD
A	PCN-808	ADS	7/18/88	ADS
B	PCN-890	ADS	12/16/88	ADS
C	89-P019	ADS	2/13/89	ADS
D	90-P067	KRC	6/26/90	
E	90-P224	HMI	11-19-90	

Procedure Title:

5108 AFTER BURN-IN PROCEDURE

9505-8300	9505-8300-03	ORIGINATOR	DATE
9505-8300-01		D. MATTE	6/28/88
9505-8300-02			
NEXT ASSY	USED ON		

TAU-TRON

A Unit of General Signal

OPERATION TITLE: 5108 AFTER BURN-IN TEST PROCEDURE

TEST PROCEDURE NO.: A65508

I. TEST EQUIPMENT REQUIRED:

1. (2) 310 Patch Cables
2. (1) Bantam Patch Cable
3. (1) 5108 Test Unit
4. (1) Data Royal Parallel Printer
5. (1) 220 Volt AC Power Source

II. FRONT PANEL FUNCTIONAL TEST

1. Turn on the 5108 unit under test (UUT) several times and check that all of the front panel LED's function.

2. Press RUN/STOP to put the unit in the STOP mode.

3. Press RECALL. The unit should display "SETUP - 0" with the "0" flashing. Do not press ENTER.

4. To ensure that all of the front panel buttons are working, press each button. All buttons except speaker volume, select < and > INCR, DECR, ENTER and EXIT should produce an error tone. Speaker volume, SELECT < and > INCR and DECR should produce a brief "chirp" tone.

5. Set the display to RECALL 0 and press ENTER. The ENTER, EXIT, INCR and DECR keys should now produce an error tone.

AUDIO ALARM TEST

1. The unit should still be in STOP mode, with RECALL 0 default setup.
   Press RUN/STOP to activate RUN mode.

2. Press the SPEAKER UP button three times. Press the SINGLE button and verify a tone each time the button is pressed, and another beep when the error is detected.

3. Set ERROR INJECT to 1E-03. Verify a constant tone. Vary the volume up and down to verify control over the volume.

4. Set the volume to OFF (speaker down).

III. PATH/TIMING TESTS

1. Set the 5108 test unit and the UUT to default settings by pressing STOP, RECALL (0), ENTER on both units.

2. Connect the DSX OUT of the UUT to the test unit DSX IN and the DSX OUT of the test unit to the DSX IN of the UUT.

3. Press RUN/STOP on both units to activate the RUN mode. Verify error free operation on both units.

4. Set the test unit to FRAME ERROR inject type, ERROR FREE. Insert a few single FRAME errors and verify that each is detected by the UUT.

5. Remove the patch cable from the UUT receiver input. Verify loss of signal and sync on the UUT but not on the test unit. Reapply the signal.

6. Set the UUT to LOOP TMD by pressing RUN/STOP, PATH TIMING, RUN/STOP.

7. Reset the test 5108. Verify error free operation and no active status indicators on both units.

8. Set the UUT to LLB by pressing RUN/STOP, PATH TIMING, RUN/STOP.

9. Reset the test 5108. Verify error free operation and no active status indicators on both units.

10. Insert a few single FRAME ERRORS on the test unit. Since the UUT is re-transmitting its receiver data, each FRAME ERROR should be detected by both units. Inserting single errors on the UUT should have no effect.

11. Set the UUT to DLB by pressing RUN/STOP, PATH/TIMING, RUN/STOP.

12. Reset the test 5108. Verify error free operation and no active status indicators on both units.

13. Insert a few single FRAME ERRORS on the test unit. Since the UUT is re-transmitting its receiver data but correcting FRAME and BPV errors, only the UUT should detect the errors.

14. Change the error inject type on the test unit to BPV. Insert a few BPV's on the test unit and verify they are only detected by the UUT.

15. Change the error inject type on the test unit to PATTERN. Insert a few PATTERN ERRORS on the test unit and verify they are detected by both units.

IV. BANTAM PRIORITY TEST

1. Leave the units connected to each other as in the previous test.

2. Set both units to their default settings by pressing RUN/STOP, RECALL (0), ENTER, RUN/STOP.

3. Set the test unit to ERROR INJECT 1E-03, PATTERN ERROR RATE. Verify that the BIT ERROR STATUS LED on the UUT comes on.

4. Connect the UUT DSX output Bantam jack to the UUT DSX INPUT Bantam jack using a Bantam patch cable. Since the Bantam interface has priority, the PATTERN ERRORS should no longer be detected on the UUT. The BIT ERROR STATUS LED should be flashing.

5. Verify that the test unit indicates LOSS of SIGNAL. (Other STATUS LED's may also be active.)

V. LOW DENSITY PATTERN TEST

1. Loop the 5108 test set on itself by connecting the transmitter output to the receiver input. Set the 5108 to its default setup by activating RECALL 0.

2. Set the 5108 to transmit 3/24 pattern, UNFRAMED. Turn on the SCAN function and set the TEST RUN mode to AUTO. Put the unit in RUN mode and verify synchronization.

3. Remove and reapply the receiver input a few times and verify that the 5108 reports NO TROUBLES FOUND. If the unit fails to sync, the clock recovery circuit needs to be readjusted in the test fixture for a free-run frequency of 25 MHz.

VI. PARALLEL PRINTER PORT TEST

1. Set the UUT to its default settings (RECALL 0). Connect the DSX OUT to DSX IN using a 310 patch cable. Reset the unit.

2. Connect a parallel printer (HP2228A or DATA ROYAL) to the front panel PARALLEL connector.

3. Set the UUT reports to OFF.

4. Put the printer on-line and press the 5108 quick report key. Verify a printout similar to the one shown in Figure 1.

VII. 220 VOLT AC POWER TEST

1. Connect the 5108 to a 220 volt AC power source, 50-60 Hz and verify proper operation. Verify that the 5108 runs properly between 210 and 250 volts AC.

   THE FOLLOWING STEPS ARE ONLY FOR UNITS WITH AC/DC POWER INPUTS:

2. Turn off the 5108 front panel power switch. Disconnect the 5108 from the 220 volt power supply. Connect the DC input terminal block on the rear of the 5108 to a DC power supply. Be sure the DC power supply is OFF when making the connection.

3. Set the power supply to about -40 volts, turn the power supply and the 5108 ON. Verify proper operation of the 5108. Note that for all DC tests, the DC voltage must be measured at the TERMINAL BLOCK to verify that the proper voltage is being applied.

4. Vary the DC power supply to -21 volts and -60 volts and verify proper operation of the 5108. There should be no errors or active status LEDs.

5. Set the power supply to -21 volts. Turn the 5108 POWER switch OFF. Wait one second and then turn it ON. Verify that the unit comes up properly and does not report an NMI FAILURE. Repeat this step five times.

6. Set the power supply to -60 volts. Turn the 5108 POWER switch OFF. Wait one second and then turn it ON. Verify that the unit comes up properly and does not report an NMI FAILURE. Repeat this step five times.

7. Set the power supply to -21 volts. Verify proper operation. Use a switched AC power cord connected from 110 VAC to the 5108, turn on the AC to the AC input while the unit is operating on DC voltage. There may be a burst of errors detected or status LEDs active when the power supply is switching from DC to AC. Verify proper operation of the unit.

8. Set the DC voltage to zero units and verify that the unit is operating properly on AC.

9. Set the DC voltage back to -21 volts. Turn the AC power switch on the 5108 OFF and then ON. Turn off the switched AC and verify that the unit is operating properly on DC. There may be a burst of errors or status LEDs when the power supply is switching from AC to DC. Verify proper operation of the unit.

10. Use a switched AC power cord connected from 240 VAC to the 5108, turn on the AC to the AC input while the unit is operating on DC voltage. There may be a burst of errors detected or status LEDs active when the power supply is switching from DC to AC. Verify proper operation of the unit.

11. Check proper operation of the 5108 using the 310 jack DC input at the -48 volts.

This completes the test.

```
-----------------------------------------
SNAPSHOT SUMMARY     1988 JUN 16 15:45:52
PERIOD START:              JUN 16 15:45:00
PERIOD LENGTH:                 00-00:00:52

RUN/STP FORMAT      CODE PATTERN  PATH
RUN     DS1 SF      AMI  QRW       INTERN

MEAS. MODE  INTFC SEL  LBO    SETUP MODE
CONT        DSX        0 DB    MANUAL

ERRORS  COUNT    ES   SES  AVG-BER  %EFS
PAT          0    0     0  0.0E+00 100.0
FRAME        0    0        0.0E+00
BPV/Os       0    0     0  0.0E+00 100.0
```

VIII. POWER LOSS TEST

1. Change the MEASUREMENT CATEGORY to ALARMS. Change the MEASUREMENT to PWR LS SEC. If this value is not zero, reset the unit (press RUN/STOP twice) and verify a display of zero.

2. Remove the AC power from the unit for approximately five seconds without turning off the unit POWER switch. Reapply the power and verify that after initialization, the unit displays approximately five PWR LS SEC.

IX. LEVEL MEASUREMENT TEST

1. Set the MEASUREMENT CATEGORY to SIGNAL. Change the measurement to DSX AMP. Verify a measured signal amplitude of 3.0 volts +/- .2v.

2. Remove the 310 patch cable from the DSX input jack. Verify that within 3 seconds the display shows "TOO LOW" and the PULSES LED near the DSX input jack is OFF.

3. Connect the LINE INTERFACE loop back cable to the LINE/PROBE connector.

4. Put the unit in STOP mode. Change the INTERFACE to LINE. Change measurement to LINE LEVEL. Activate the RUN mode.

5. Verify a measured LINE LEVEL between -2.0 and 0 dBdsx.

6 Remove the LINE INTERFACE loop back cable. Verify the unit displays "TOO LOW" within 3 seconds.

7. Reconnect the Line Interface loop back cable. Reset the unit and activate the SCAN mode. Verify that no trouble are reported.

NOTE: Excess jitter may be reported.

8. Put the unit in STOP mode. Set the interface LBO to 7.5dB. Activate the RUN mode and verify that no troubles are reported.

NOTE: Excess jitter may be reported.

9. Turn off the SCAN mode.

0. Put the unit in STOP mode. Set the interface LBO to 15dB. Turn on the SCAN feature and activate the RUN mode. Verify that no troubles are reported.

NOTE: Excess jitter may be reported.

1. Turn off the SCAN mode.

2. Put the 5108 into the stop mode. Set the interface LBO to 0dB. With the test fixture and its cable, connect one end to the LINE/PROBE on the 5108 and the other end to position 4 on the test fixture.

3. Verify a measures line level of -6 to -4 dBdsx.

4. Connect the 5108 to the 8dB port of the FQA LBO. Verify a measured line level of -10 to -8 dBdsx.

5. Connect the 5108 to the 16dB port of the FQA LBO. Verify a measured line level of -18 to -16 dBdsx.

6. Set the unit back to its factory default settings by pressing RUN/STOP, RECALL, ENTER.

OPTION TESTS

If jitter is installed, cycle through the category using the CATEGORY key until jitter shows in the display. Cycle through the measurement using the key marked Measurement until Cur Amp shows on the display. Verify that the jitter is locked and that the intrinsic jitter is less than .07 UI.

. Remove the 310 patch cable and verify that the measured jitter is replaced by the "OUT OF LOCK" message.

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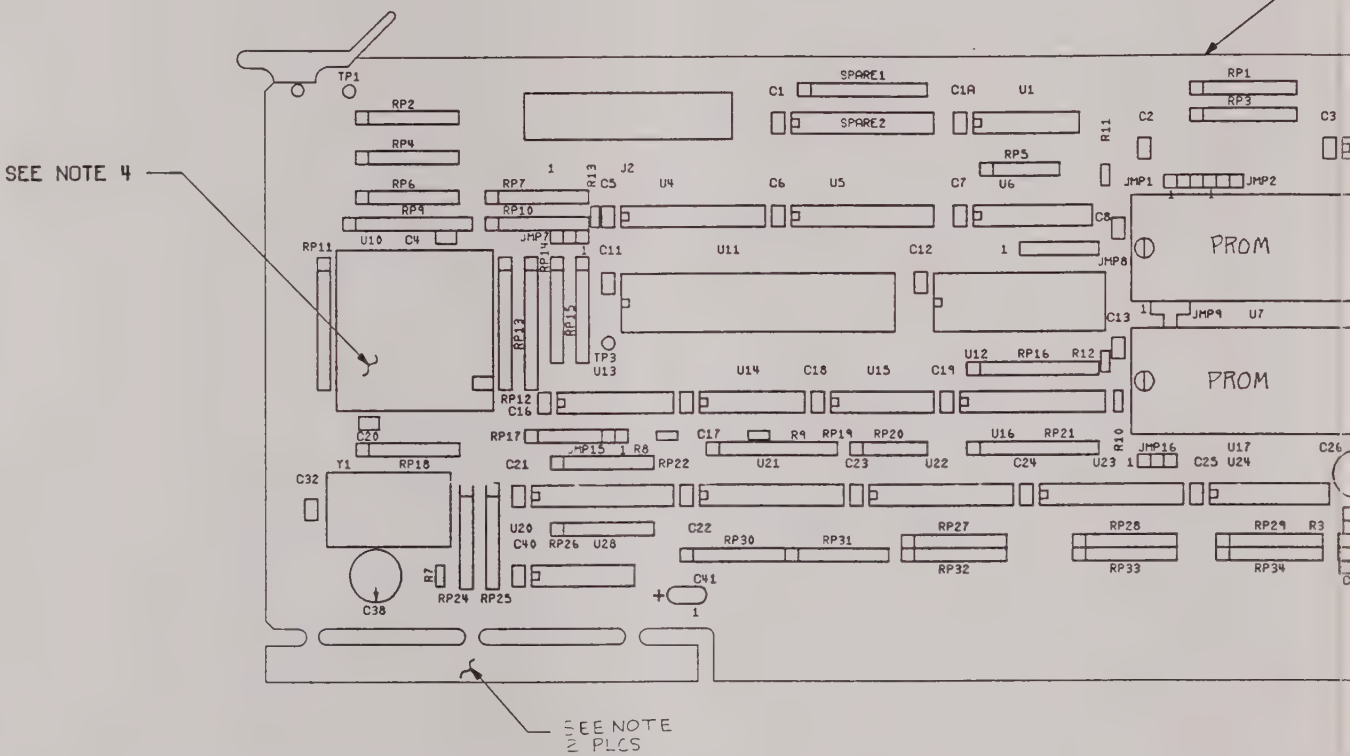


TABLE						
	FOR PARTS LIST: 9545-8426		FOR PARTS LIST 9545-8426-01		FOR PARTS LIST 9545-8426-02	
JUMPER	LOCATION	FIG	LOCATION	FIG	LOCATION	FIG
JMP1	1-2	1	1-2	1	1-2	1
JMP2	2-3	1	2-3	1	2-3	1
JMP3	1-2	1	1-2	1	1-2	1
JMP4	2-3	1	2-3	1	2-3	1
JMP5	2-3	1	2-3	1	2-3	1
JMP6	2-3	1	2-3	1	2-3	1
JMP7	2-3	5	2-3	5	2-3	5
JMP8	1-2, 5-6	3	1-2, 5-6	3	1-2, 5-6	3
JMP9	2-4	2	2-4	2	2-4	2
JMP10	2-3	2	2-4	2	2-4	2
JMP11	1-2	1	2-3	1	2-3	1
JMP12	2-3	1	2-3	1	2-3	1
JMP13	1-2	2	1-2	2	1-2	2
JMP14	2-3	1	2-3	1	2-3	1
JMP15	JUMPER	4	JUMPER	4	JUMPER	4
JMP16	1-2	1	1-2	1	1-2	1
JMP17	2-4	2	1-2	2	1-2	2
JMP18	—	—	—	—	—	—

FIGURE 1

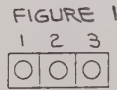


FIGURE 2

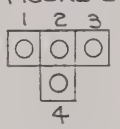


FIGURE 3

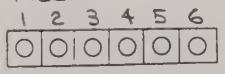
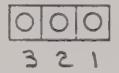
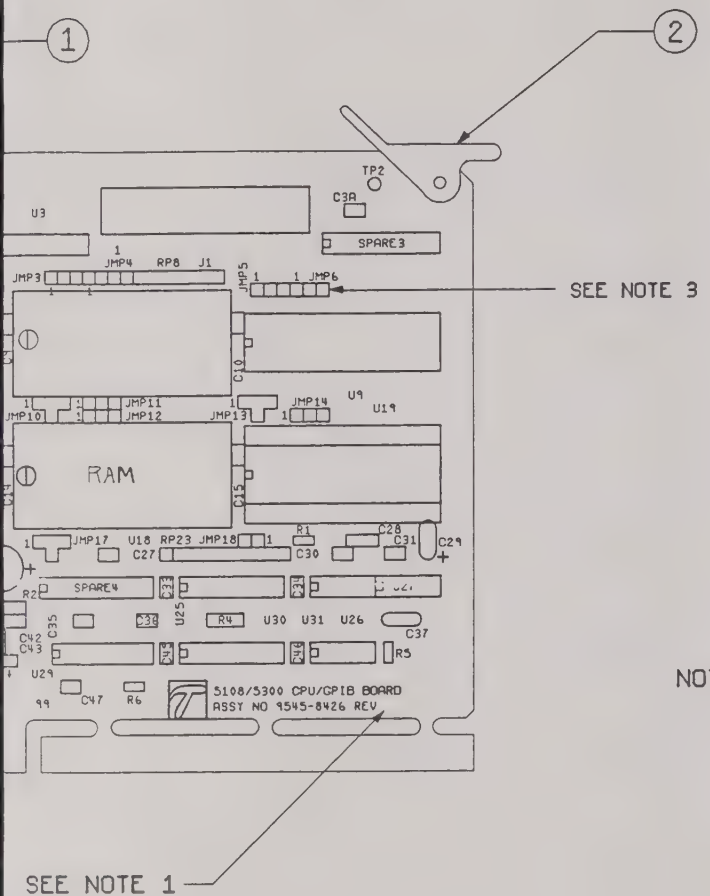


FIGURE 4

FIGURE 5



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	B	REV PER ECO #03047 RJA 8/9/88	8/15/88	
	C	REV PER ECO # 03115 MCD 12-22-88	1-24-89	
	D	REV PER ECO # 89-E001 MCD 1/27/89	2-1-89	
	D1	REV PER AUDIT # 89-A052 MCD 3/28/89	4/10/89	
	E	REV PER ECO #89-E116 DMB 9-27-89		
	F	REV PER ECO # 90-E140 MCD 9-27-90	12-4-90	
	F1	REV PER AUDIT # 91-A062 MCD 7-24-91	7/26/91	



NOTES:

1. PLACE THE ASSEMBLY PARTS LIST REVISION MARK ON THE ASSEMBLY IN THE DESIGNATED AREA.
2. CORNER PIECES TO BE REMOVED AFTER WAVESOLDER.
3. INSTALL JUMPERS TO INDICATED LOCATIONS PER TABLE AND FIGURES 1,2,3,4&5 FOR APPLICABLE PARTS LIST.
4. ADD THERMAL COMPOUND, ITEM # 3 TO HEATSINK IN TEST INSTALLATION. (-01 DOES NOT USE HEAT SINK.)

9545-8426-02	5120
9545-8426-01	5300
9545-8426	5108
NEXT ASSY	USED ON

APPLICATION

WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ± N/A
FRACTIONS ± N/A
3 PLACE DECIMALS ± N/A
2 PLACE DECIMALS ± N/A
1 PLACE DECIMALS ± N/A
MATERIAL: N/A

CONTR NO.

DR	ACDT	3/9/88
CHK	RL	3/28/88
APPD	VL	4/01/88
PPD	WEL	4/22/88

APPROVED
BY DIRECTION OF

TAU-TRON
A UNIT OF GENERAL SIGNAL

DRAWING TITLE 5108/5300
CPU/GPIB BOARD ASSEMBLY DRAWING

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		58426	F1

SCALE 1.5/1 | 5108/5300/5120 | SHEET 1 OF 1

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74HC390 100Ω RP17-6
U13 CLKB QD CLKA QC
R9 47Ω 3.0088MHZ ⎍40%
JMP15
R8 47Ω
+5 15.44 MHZ ± 1ppm
Y1 XTAL OSC
C32 .01
U1A 74ACT04
R7 47Ω
C38 (5~30) PF TRIMMER CAP

U10 80188
RP24 47Ω
74HC373 U20
A0 RP26
A1 RP22
A2 RP26
A3 RP22
A4 RP26
A5 RP22
A6 RP26
A7 RP22
RP17-3 100Ω
RP11-9
RP15 RP14 RP25
RP17-2 100Ω
ADIN1 ADIN2
RP16-2 10K RP16-9 10K
74HC32 U28
INT1 INT3/INTA1
RP7 RP10 RP6 RP4 RP2 RP18
74HC32 U28
(2B2) GP1B INT
74HCT244 U16
U14 ACT04
INT3 NMI TPTF INTO RESET TPBE TPBV TPRF
RP21-6 RP20-6 RP20-4
RP12-6 RP11-6 RP9-6
RP9-10 RP7
R13 10KΩ +5V
R12 120Ω R11 120Ω
RP16 10K RP20 100Ω
TP3
BTPBE BTPBV BTPRF
RP21-4
JMP8
82C54 U12
CLK0 CLK1 CLK2 GATE0 GATE2 GATE1
OUT0 OUT1 OUT2
RD WR CS
D0 D1 D2 D3 D4 D5 D6 D7
ALE
DATA BUS D0~D7
ADDRESS BUS
SMART WATCH SOCKET
RAM 8K U19
JMP14 JMP18
ZIP SOCKET
JMP16 +5
WE CS OE WR RD

To PIN 26 OF RAM DEVICE Mounted on U19 Smart Watch Socket (1, D, 5)

74HC138 U6
PCS0+40H PCS0+48H PCS0+50H PCS0+58H
U1 74HC32
(2B3)
RP5-6 100Ω
TP2 TP1

+5
DIP STYLE CAPACITORS
U3, U13, U14, U21, U22, U23, U24, U20

C41 33MF TANT. .01MF CER
C1, C1A, C2, C3, C3A, C4-C25, C27, C31, C33, C34, C40, C43, C45, C46

RP23-6
74HC74 U25
X9104 U31
R5 33K
U29
C94 .047 MF
74HC74 U30
74HC74 U30
RP23-3

TONE

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	1	PER ECN 748 DWT 88 APR 19	4/20/88	FC VL
	A	REL PER F0024 MCD 4/21/88	4/22	
	B	REV PER ECO # 03029 MCD 6-24-88	6/30/88	
	C	REV PER ECO # 03069 MCD 8/4/88	8-4-88	
	D	REV PER ECO # 03081 RJA 8/15/88	8/16/88	
	E	REV PER ECO # 03047 RJA	10/18/88	
	F	REV PER ECO # 03115 MCD 12-22-88	1-24-89	
	G	REV PER ECR # NP881 MCD 3/1/89	3/6/89	
	H	REV PER ECO 89-E091 DMB 4/12/89	4/14/89	
	J	REV PER ECO 89-E116 DMB 4/27/89		
	K	REV PER ECO # 90-E076 MCD 5-15-90	06/06/90	
	K1	REV PER AUDIT # 90-A116 MCD 12-9-90	12-20-90	

A0 ~ A15

UNIVERSAL MEMORY LOCATION

UNIVERSAL MEMORY LOCATION ZIP SOCKET

JMP5 JMP6 JMP19 JMP11 JMP12 JMP17

U9 U18

ADDRESS BUS A0 ~ A15 (2C6)

DATA BUS (2B6)

CONTROL SIGNALS (2C6)

U17

U5 74HC30 U14 74ACT04

U28 74HC32

DT/R

U23 74HC244 47Ω RP33 RP28 RP32 RP29 RP33 RP28

SA7 SA6 SA5 SA4 SA3 SA2 SA1 SA0

U21 74HC245 RP9 4.7Ω RP21

SD7 SD6 SD5 SD4 SD3 SD2 SD1 SD0

DIR

A→B : DIR = HI

U22 74HC244 RP32 RP27 RP32 RP27 RP32 RP27

SPCS6 SPCS5 SPCS4 SPCS3 SPCS2 SPCS1 OSC RSTD

U24 74HC367 RP34 RP29 RP34 RP34 RP29

RD WR ALE INTA0 CLK/3.0938 TPEI

100Ω RP20-4

U26 X9103 R4 301K

U29 R6 4.7K R2 562Ω 1% R3 3.32K 1% C36 .01MF C42 .1MF C35 .1MF C47 .1MF

U27 LM386 C29 10MF C30 .1MF C38 .047MF R1 10Ω C37 .0001MF C26 47MF

SPKR+ SPKR-

S VOL GENERATION

REFERENCE DESIGNATIONS	
LAST USED	UNUSED
U31	U2
C13	C39
R34	
R47	
R1	
-	
C118	

WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64

9545-8426-02	5120
9545-8426-01	5300
9545-8426	5108
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ± ~
FRACTIONS ± 1/64
3 PLACE DECIMALS ± .010
2 PLACE DECIMALS ± .03
1 PLACE DECIMALS ± .1
MATERIAL:

CONTR NO.

DR	VINH LE	DEC 87
CHK	FC	3/31/88
APPD	VL	4/1/88
	NEA	4/22/88

APPROVED

BY DIRECTION OF

tau-tron

DRAWING TITLE SCHEMATIC
CPU/GPIB CARD
5108 / 5300 / 5120

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		58424	K1

SCALE ~ | 5108 | SHEET 1 OF 2

58424

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TABLE				
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JMP1	1-2	1	1-2	1
JMP2	2-3	1	2-3	1
JMP3	1-2	1	1-2	1
JMP4	2-3	1	2-3	1
JMP5	2-3	1	2-3	1
JMP6	2-3	1	2-3	1
JMP7	2-3	5	2-3	5
JMP8	1-2, 5-6	3	1-2, 5-6	3
JMP9	2-4	2	2-4	2
JMP10	2-3	2	2-4	2
JMP11	1-2	1	2-3	1
JMP12	2-3	1	2-3	1
JMP13	1-2	2	1-2	2
JMP14	2-3	1	2-3	1
JMP15	JUMPER	4	JUMP	4
JMP16	1-2	1	1-2	1
JMP17	2-4	2	1-2	2
JMP18	-	-	-	-

FIGURE 1

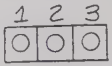


FIGURE 2

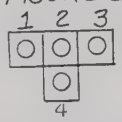


FIGURE 3

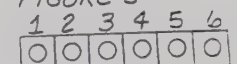
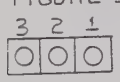
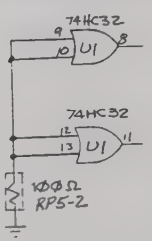


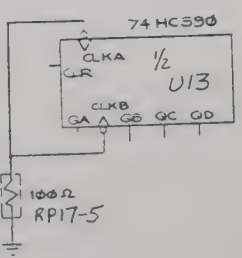
FIGURE 4

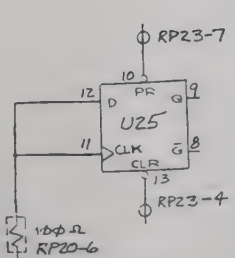
FIGURE 5

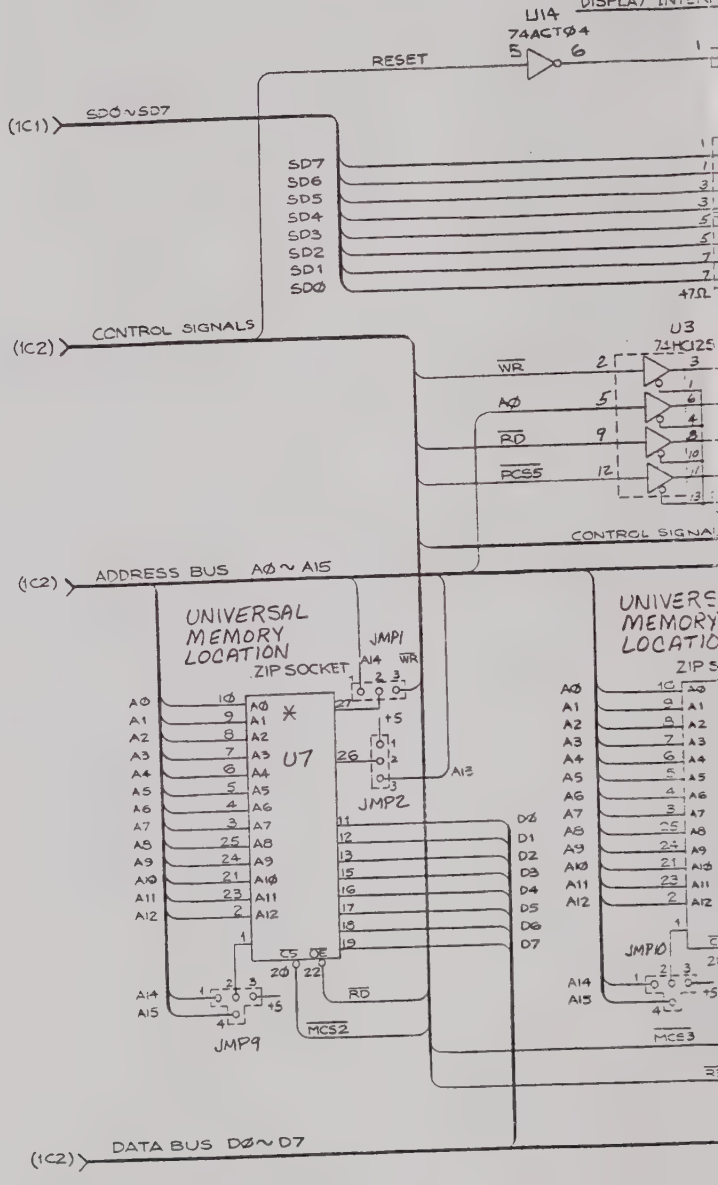


SPARE GATES

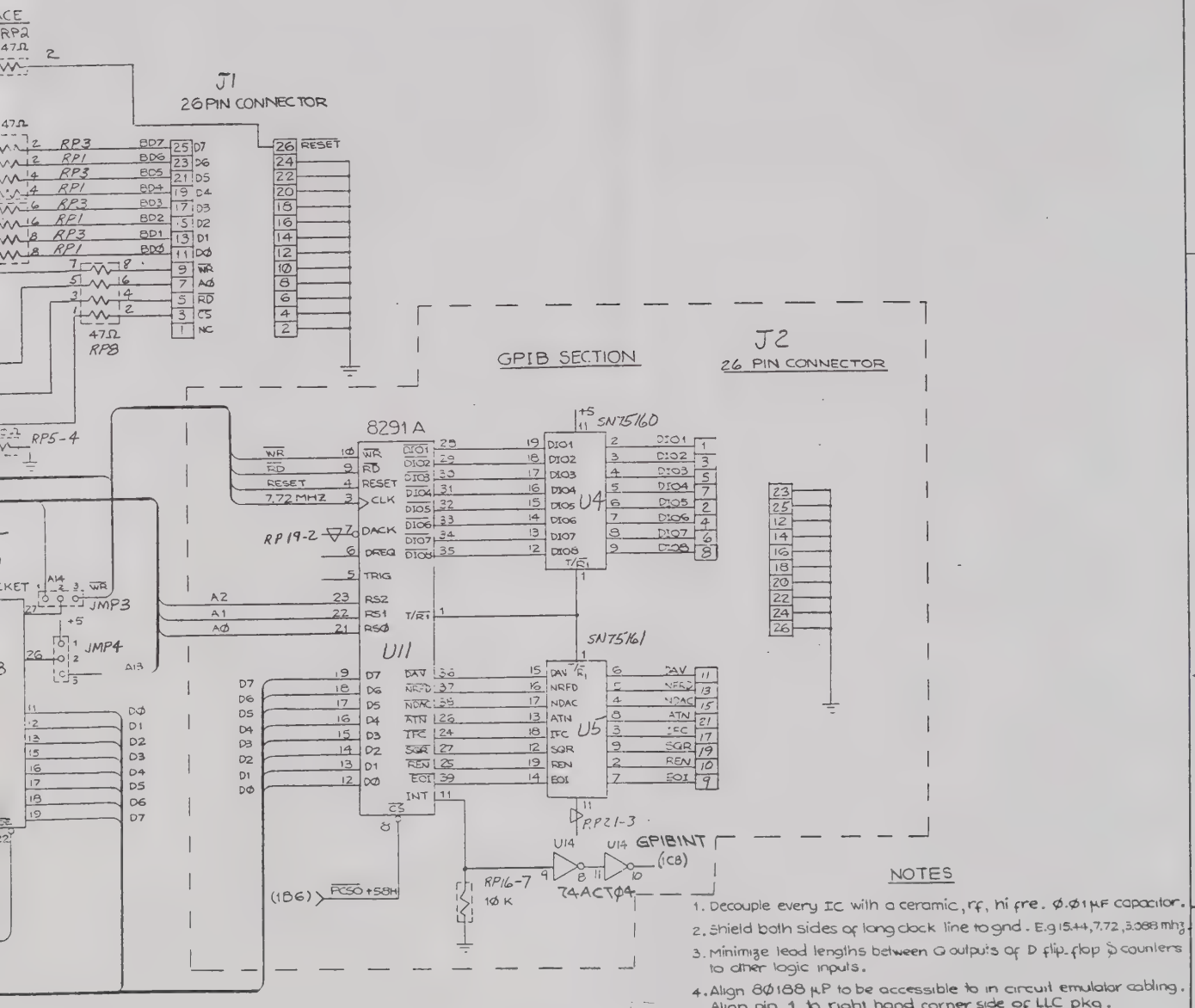








ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1 FOR REV		



NOTES

1. Decouple every IC with a ceramic, rf, hi fre. .01 µF capacitor.
2. Shield both sides of long clock line to gnd. E.g 15.44, 7.72, 3.088 mhz.
3. Minimize lead lengths between Q outputs of D flip-flop & counters to other logic inputs.
4. Align 8088 µP to be accessible to in circuit emulator cabling. Align pin 1 to right hand corner side of LLC pkg.
5. Add 2 gnd test points from gnd plane.
6. All unused inputs are gnd'ed by 100 Ω sip resistors.
7. * Indicates device in socket.
8. Ø Ω resistors to be installed to match memory requirements.
9. ▽ 10K resistor to +5.
10. —[W]— sip resistor.
11. —Θ— 4.7KΩ RESISTOR TO +5V.

58424

WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± FRACTIONS ± 3 PLACE DECIMALS ± 2 PLACE DECIMALS ± 1 PLACE DECIMALS ± MATERIAL:	CONTR NO. DR VINH LE — DEC,87 CHK APPD APPROVED BY DIRECTION OF	tau-tron DRAWING TITLE SCHEMATIC CPU/GPIB CARD 5108 / 5300 / 5120
NEXT ASSY: 510 SH 1	USED ON		SIZE D — CODE IDENT NO. — DRAWING NO. 58424 — REV K1
APPLICATION			SCALE — 5108 — SHEET 2 OF 2

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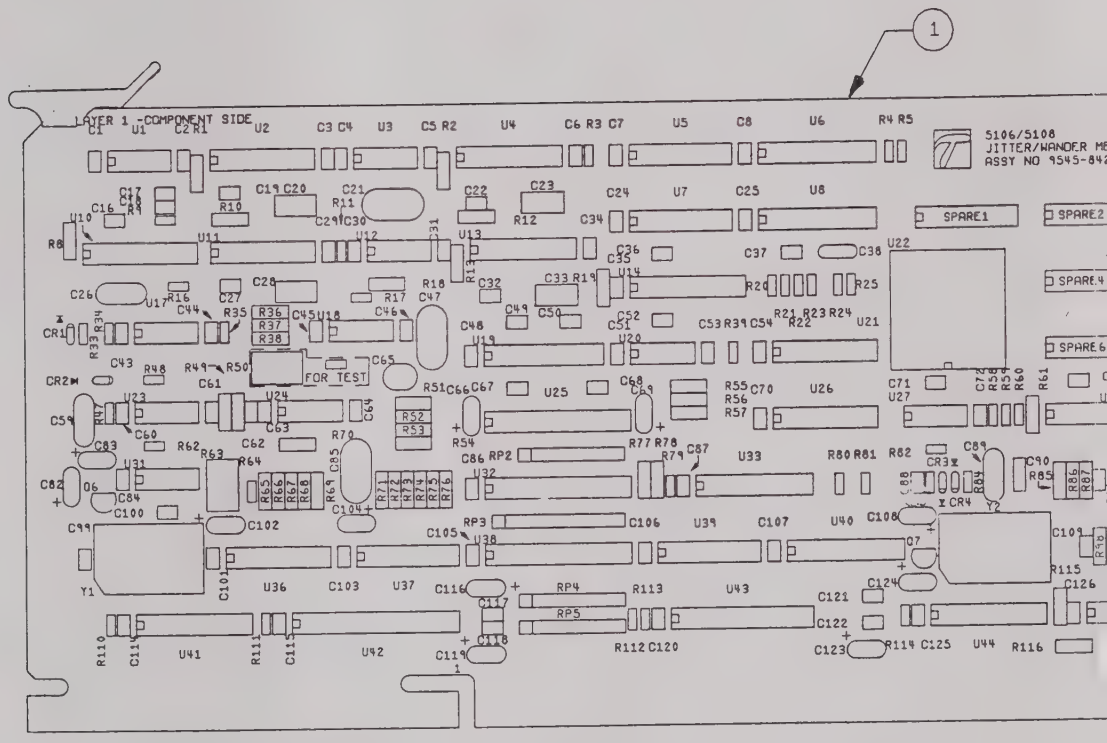
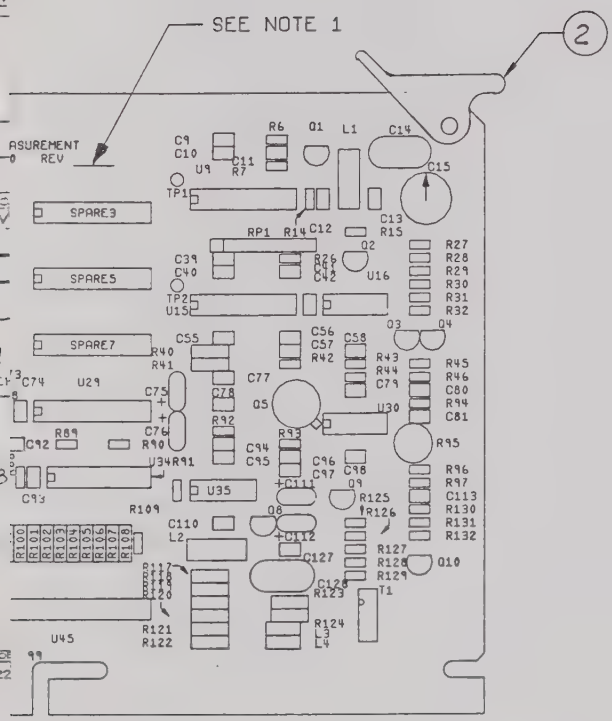


REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	1	REV PER ECN *NP750 CA	5/4/88	KC/JD
	A	REL PER P0035 MLD 6/1/88		



NOTES:

1. PLACE THE ASSEMBLY PARTS LIST REVISION MARK ON THE ASSEMBLY IN THE DESIGNATED AREA.

58420

WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	CONTR NO.	tau-tron (A UNIT OF GENERAL SIGNAL)
	TOLERANCES: ANGLES ±	DR L. BATES 05FEB88	
	FRACTIONS ±	CHK 5/19/88	DRAWING TITLE
	3 PLACE DECIMALS ±	APPD 2/10/89	ASSEMBLY JITTER/WANDER MEASUREMENT
	2 PLACE DECIMALS ±	APPD 5-31-89	
	1 PLACE DECIMALS ±	MATERIAL:	
5106		APPROVED	SIZE D / CODE IDENT NO. / DRAWING NO. 58420 / REV A
5113		BY DIRECTION OF	SCALE 1.5 / STAG / SIZE / SHEET 1 OF 1
NEXT ASSY / USED ON			
APPLICATION			

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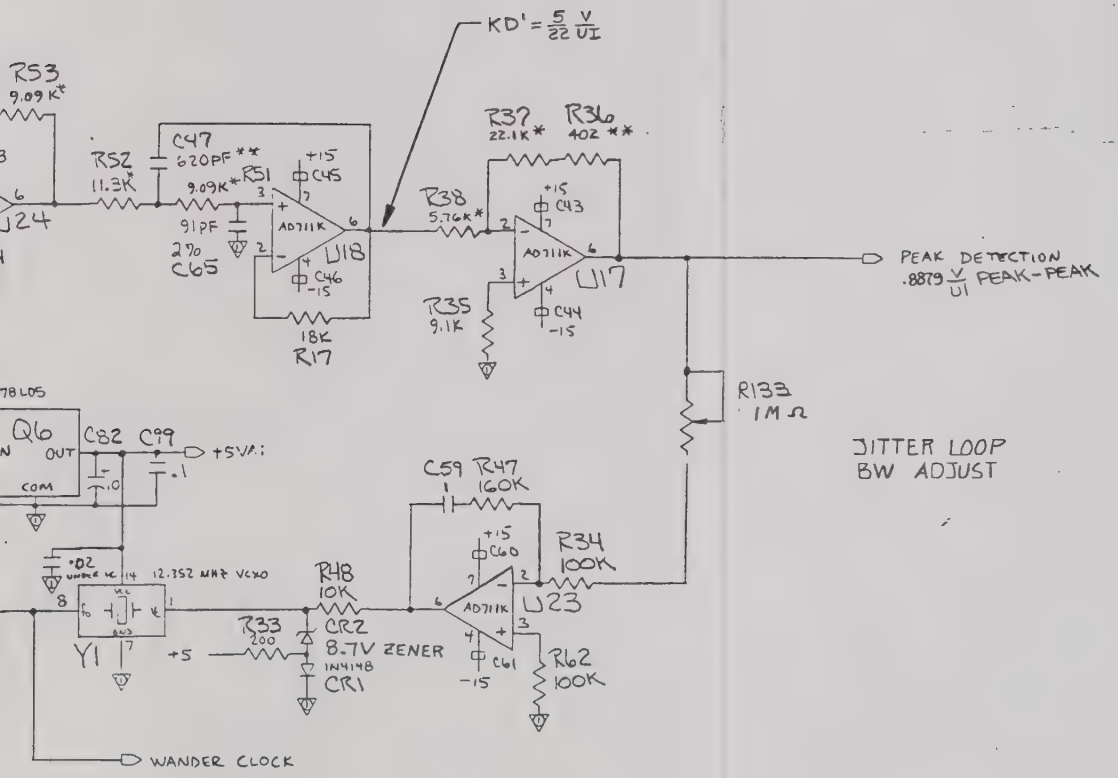
NOTES:

1. 10 KΩ to +5
2. 100 Ω to Digital GND
3. ALL POWER PINS TO IC'S BYPASSED WITH 0.1 μF CAPACITOR TO RESPECTIVE GROUNDS, ⏚ = .1 μF cap
4. ALL IC'S WITH UNMARKED POWER SUPPLY USE VCC = +5, GND = DIGITAL GND
5. * INDICATES 0.1% TOLERANCE
   ** INDICATES 1% TOLERANCE
   UNMARKED INDICATES 5% TOLERANCE

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	1	REV PER ECN # NP750 EA	5/4/88	RL
	A	REL PER P0035 MCD 6/1/88		
	B	REV PER ECO # 03046 MCD 7/6/88	7-20-88	
	C	REV PER ECO # 03057 MCD 8/2/88	8-3-88	
	D	REV PER ECO # 03070 MCD 8/12/88	8-15-88	
	E	REV PER ECO # 90-E149 MCD 8-27-90		
	E1	REV PER AUDIT #90-A126 MCD 1-24-91	1-24-91	KRC
	F	REV PER ECO # 91-E099 MCD 6-5-91	6-17-91	KRC



SPARE RESISTOR PKG PINS

△ △ → RP2 - 2,5 (sht 1)

△ → RP1-2 (sht 4)

58418

REFERENCE DESIGNATORS			
	UNUSED	LOGIC USED	UNUSED
		S1	
	R116		

WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES: ANGLES ± ~

FRACTIONS ± ~

3 PLACE DECIMALS ± ~

2 PLACE DECIMALS ± ~

1 PLACE DECIMALS ± ~

MATERIAL:

CONTR NO.

DR	Jerry Gentile	1/15/88
CHK		2/17/88
APPD		2/25/88
APPD		5-31-88

APPROVED

BY DIRECTION OF

tau-tron

DRAWING TITLE

SCHEMATIC
JITTER/WANDER MEASUREMENT

SIZE	CAGE CODE	DRAWING NO.	REV
D	1JL37	58418	F

SCALE NONE | 5106151018 | SHEET 1 OF 4

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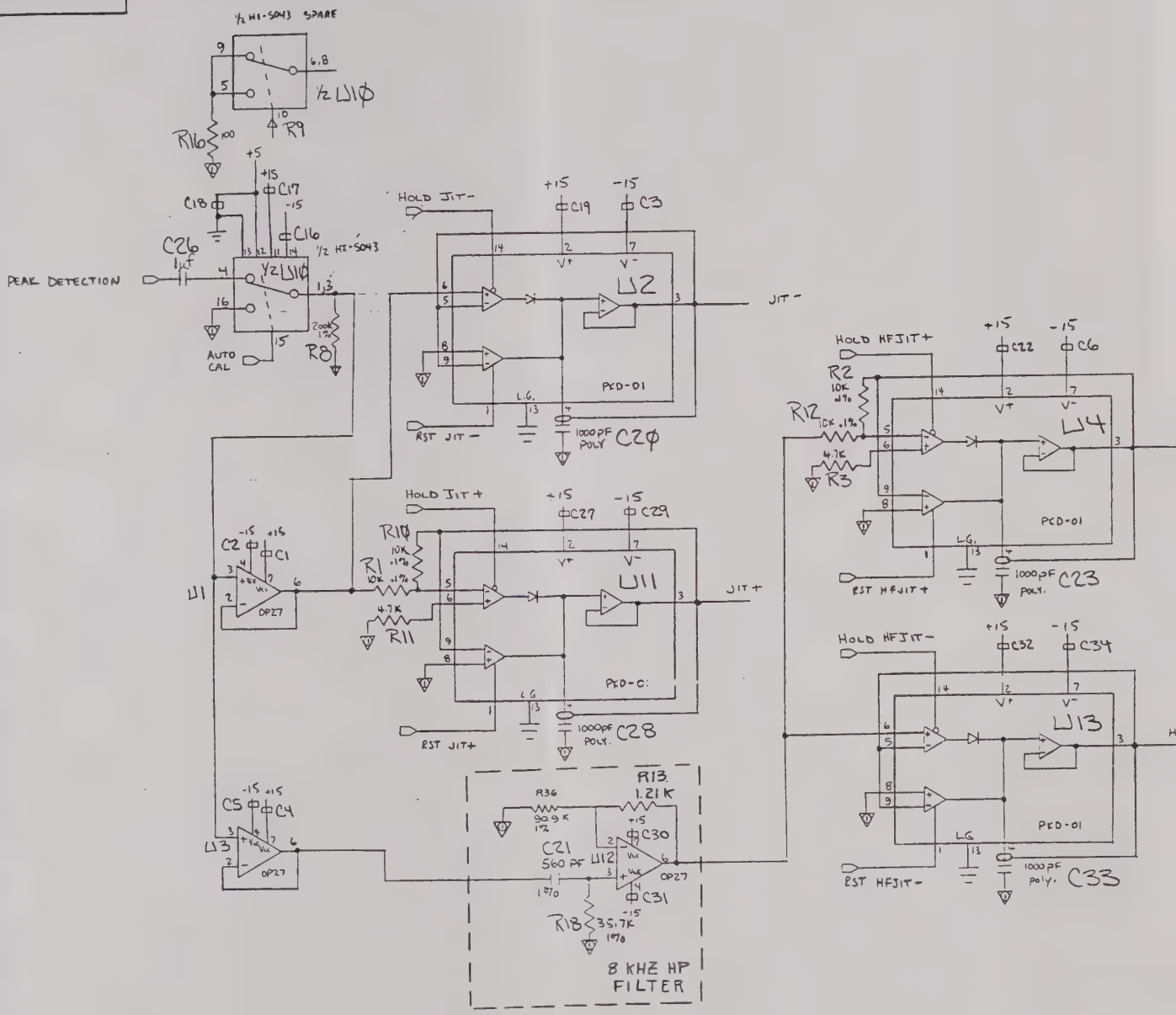


A/D START

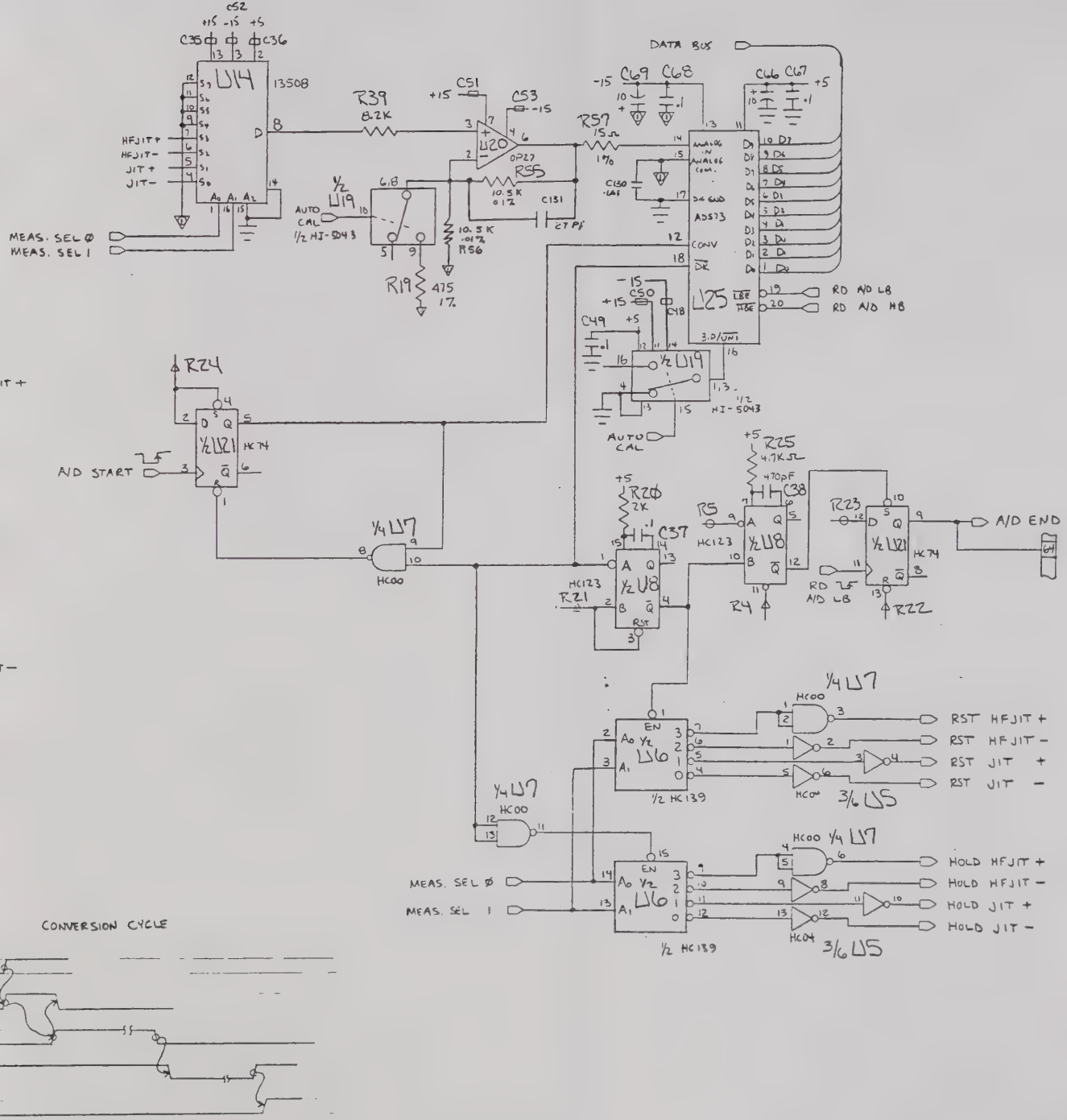
CONVERT

$\overline{\text{DATA RDY}}$, HOLD JIT

RESET JIT

A/D END

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE	APPROVED
SEE SHEET ONE FOR REVISIONS			



WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± FRACTIONS ± 3 PLACE DECIMALS ± 2 PLACE DECIMALS ± 1 PLACE DECIMALS ±	CONTR NO.	tau-tron (A UNIT OF GENERAL SIGNAL)		
	MATERIAL:	DR	DRAWING TITLE: SCHEMATIC JITER/WANDER MEASUREMENT		
		CHK			
		APPD			
NEXT ASSY / USED ON		APPROVED	SIZE: D	CAGE CODE: 1JL37	DRAWING NO.: 58418
APPLICATION		BY DIRECTION OF	SCALE: NONE	5106/5108	SHEET 2 OF 4

REV F

58418

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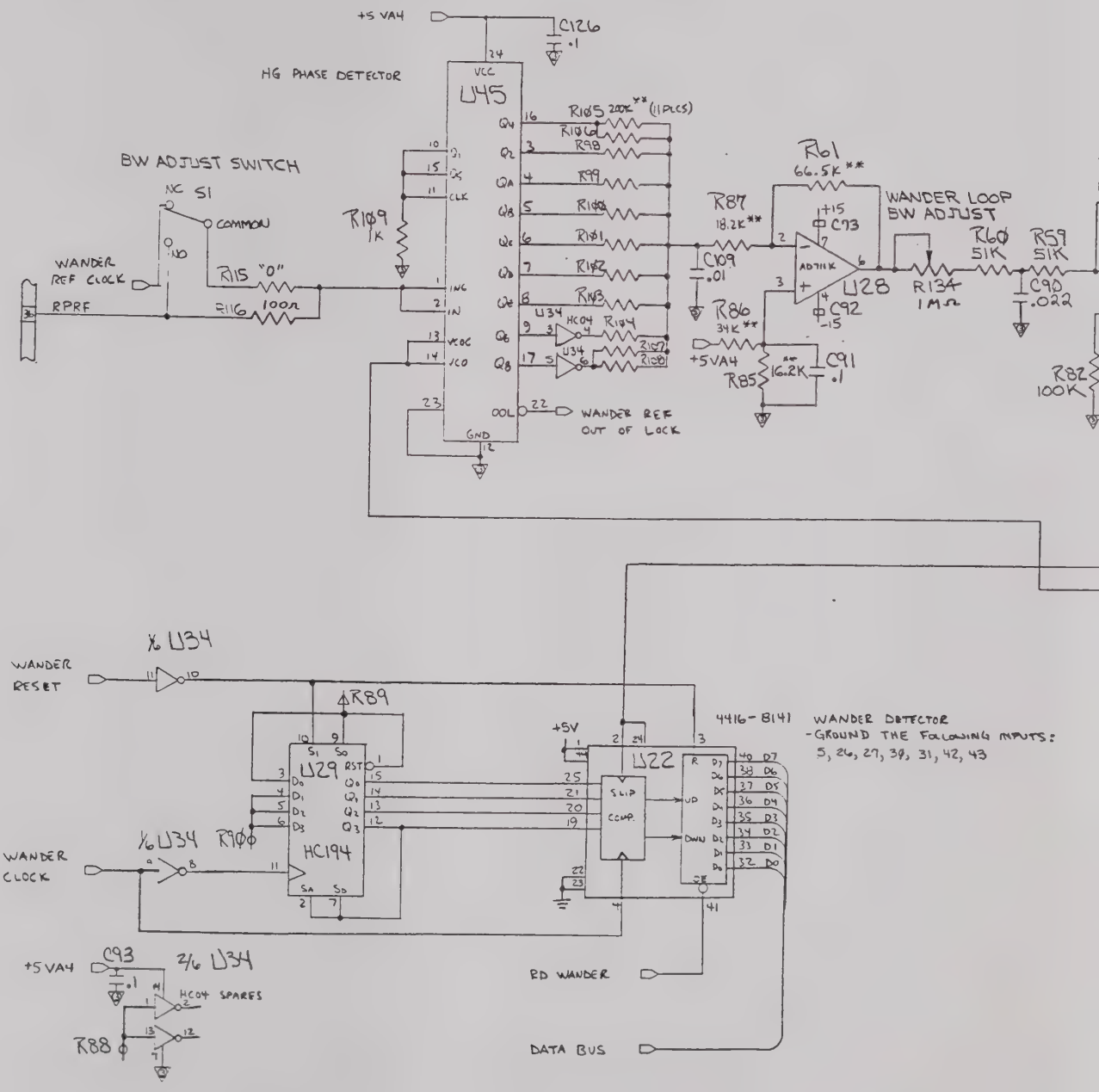
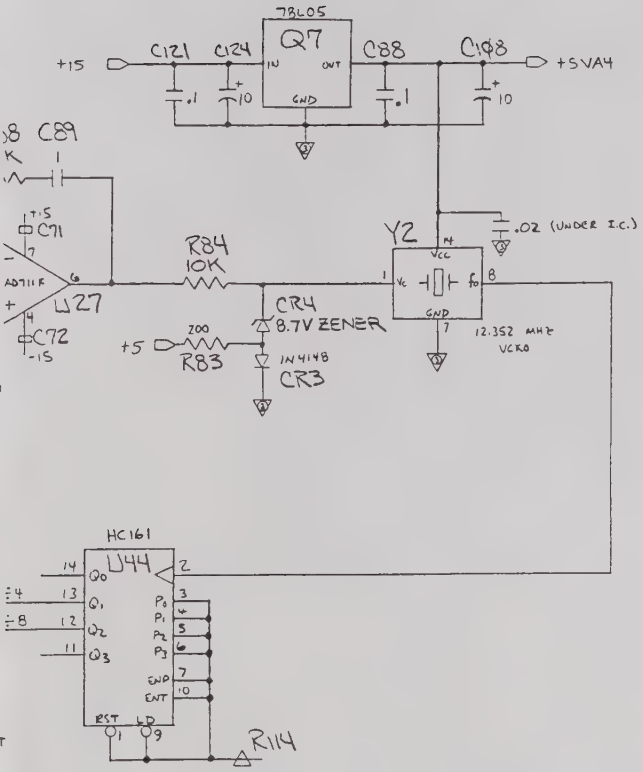


REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHT. 1 FOR REVISIONS		



WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± ± FRACTIONS ± ± 3 PLACE DECIMALS ± ± 2 PLACE DECIMALS ± ± 1 PLACE DECIMALS ± ± MATERIAL:	CONTR NO. DR CHK APPD APPROVED BY DIRECTION OF	tau-tron A UNIT OF GENERAL SIGNAL DRAWING TITLE SCHEMATIC JITTER/WANDER MEASUREMENT		
NEXT ASSY / USED ON APPLICATION			SIZE D CODE IDENT NO / CAGE CODE 1JL37 DRAWING NO. 58418 REV F SCALE NONE SHEET 3 OF 4		

D

C

B

A

58418

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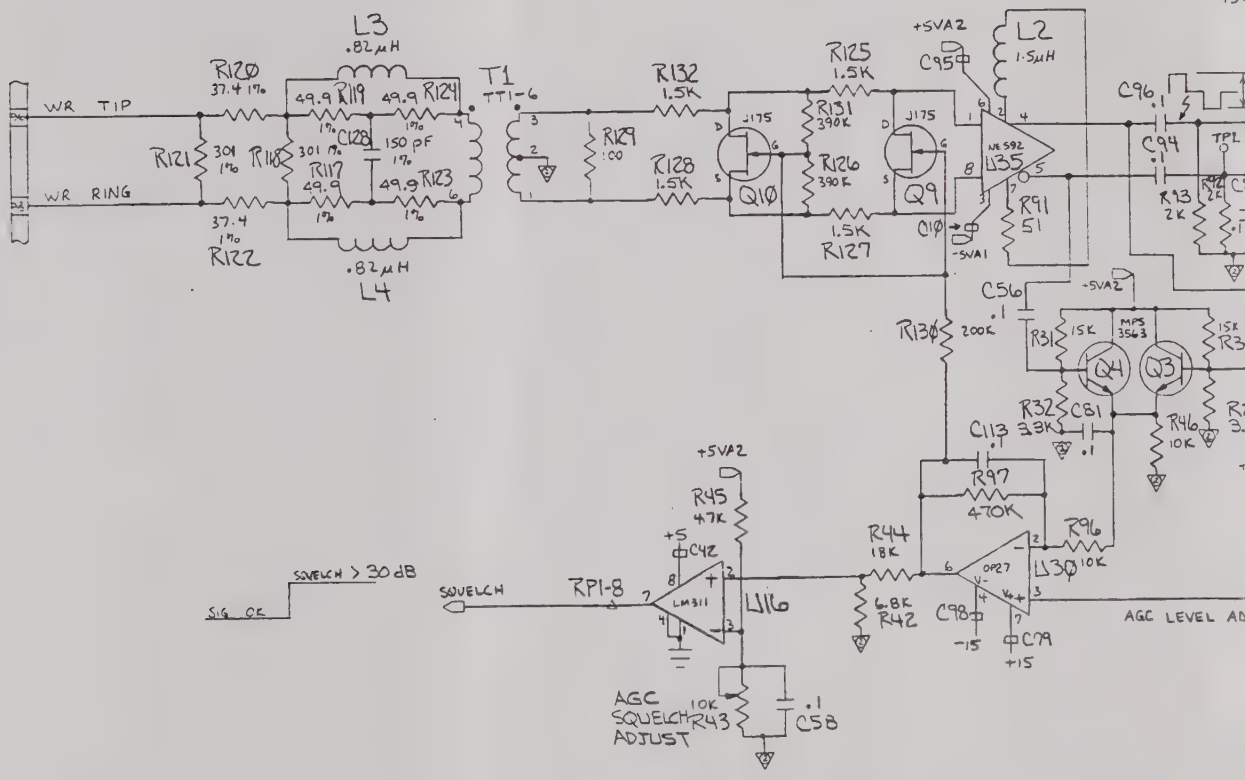
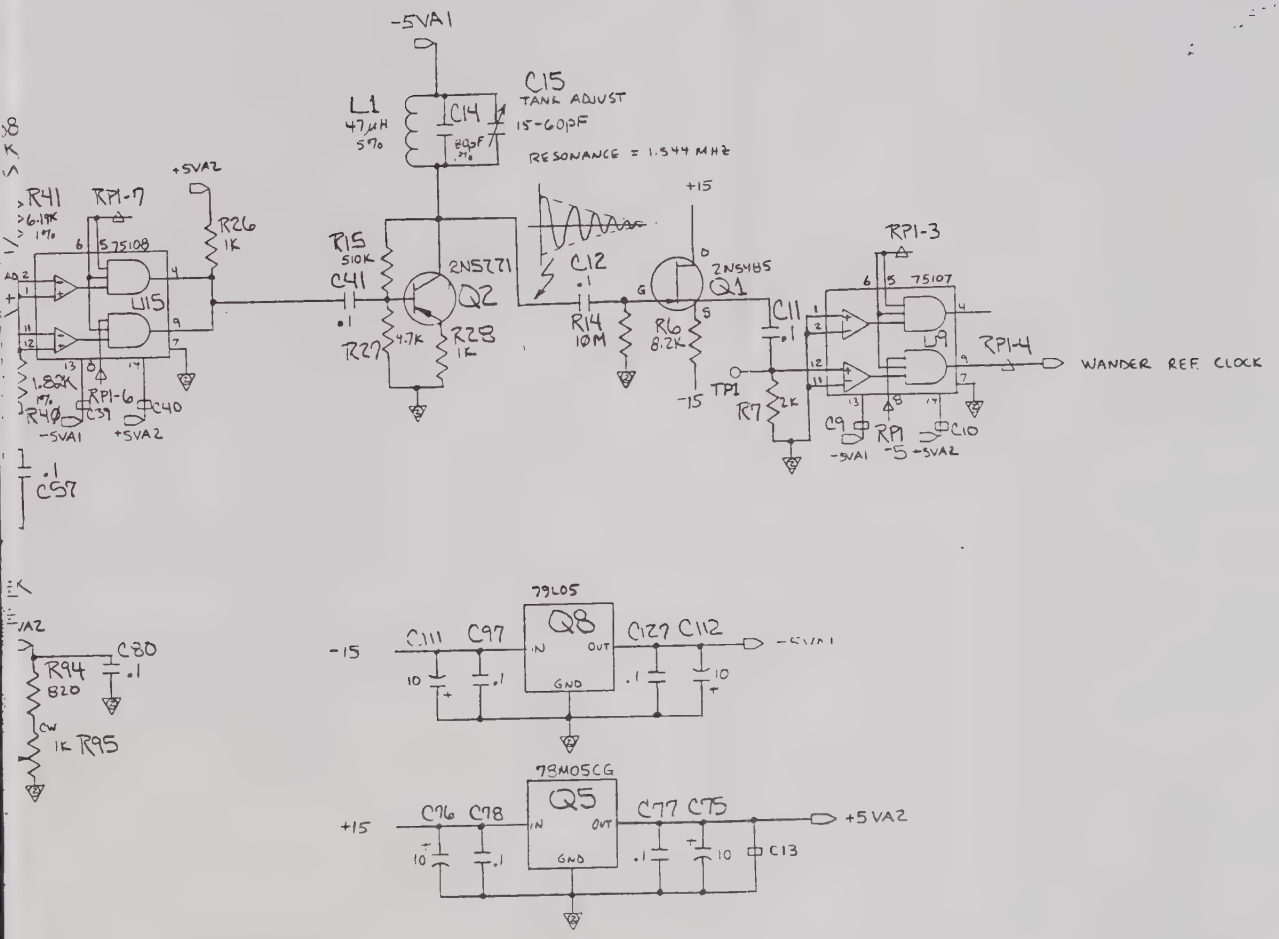
OLELY FOR THE PURPOSE PRO-
DED, AND IS NOT TO BE DISCLOSED
O OTHERS WITHOUT THE PRIOR
TTEN CONSENT OF TAU-TRON



REVISIONS			
ZONE	LTR	DESCRIPTION	DATE	APPROVED
SEE SHEET ONE FOR REVISIONS			



WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± FRACTIONS ± 3 PLACE DECIMALS ± 2 PLACE DECIMALS ± 1 PLACE DECIMALS ±	CONTR NO.	tau-tron A UNIT OF GENERAL SIGNAL	
	MATERIAL.	DR CHK APPD APPROVED BY DIRECTION OF	DRAWING TITLE SCHEMATIC TIMER/WANDER MEASUREMENT	
NEXT ASSY / USED ON APPLICATION			SIZE D / CODE IDENT NO / CAGE CODE 1JL37 / DRAWING NO. 58418 / REV F SCALE NONE / 5106/510R / SHEET 4 OF 4	

58418

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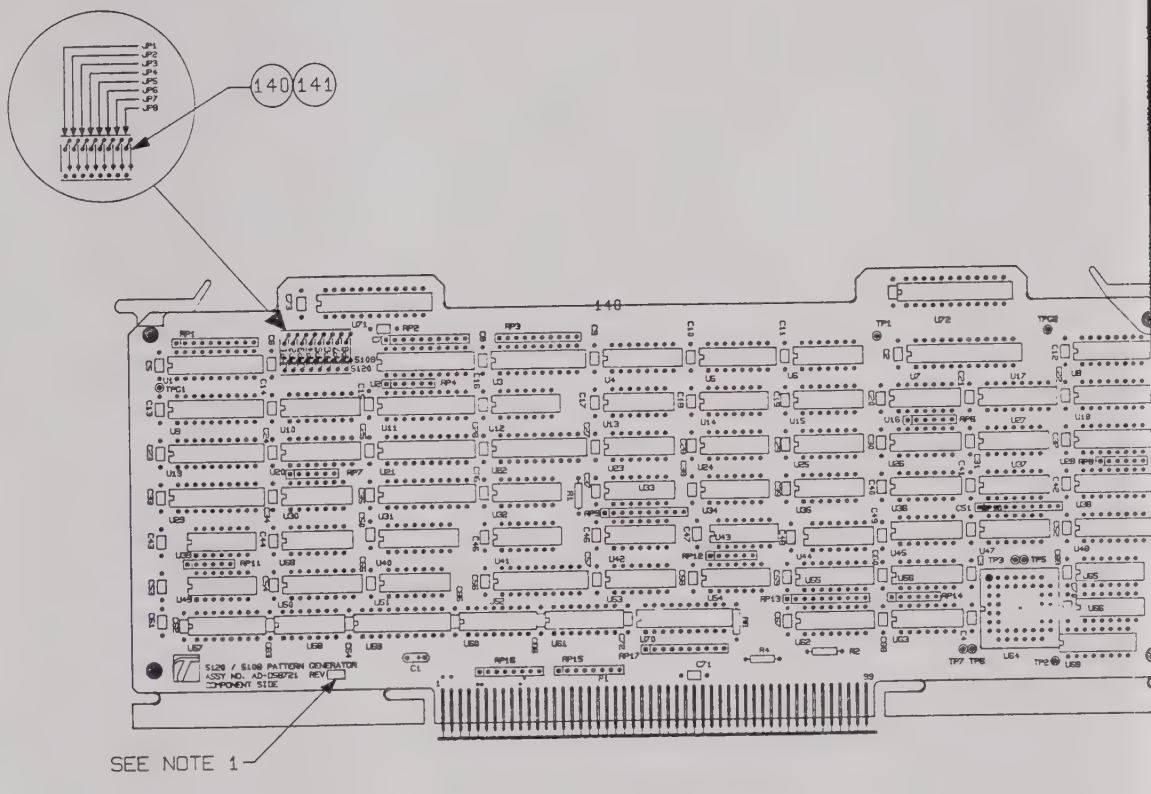
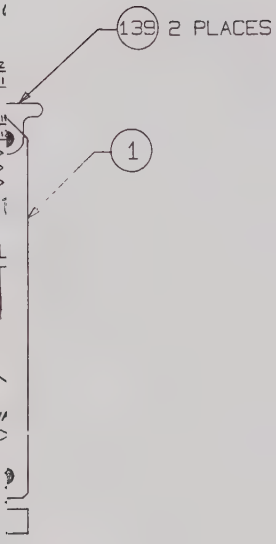


COMPONENT SIDE

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	00	ORIGINAL RELEASE		
	01	REV PER 90-N016 MEH	5-21-90	R.MARTIN
	02	REV PER 90-N051 MD	9-10-90	CC
	03	REV PER 90- N061 RCM	9-27-90	CFC
	A	REL PER 90-PRN11 11-17-90 MCD	9-27-90	CFC
	A1	REV PER 90-A128 MCD 1-17-91	1-24-91	[illegible]



NOTES:
1. PLACE THE ASSEMBLY PARTS LIST REVISION MARK ON THE ASSEMBLY IN THE DESIGNATED AREA.

WHERE APPLICABLE: REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± FRACTIONS ± 3 PLACE DECIMALS ± 2 PLACE DECIMALS ± 1 PLACE DECIMALS ±
5120/5112	MATERIAL:
NEXT ASSY / USED ON	
APPLICATION	

CONTR NO.

FILE NAME: PGASSY

DR ROGER MARTIN

CHK

APPD T.CULLINAN 11-19-90

T. JOHNSON 11-19-90

APPROVED

BY DIRECTION OF

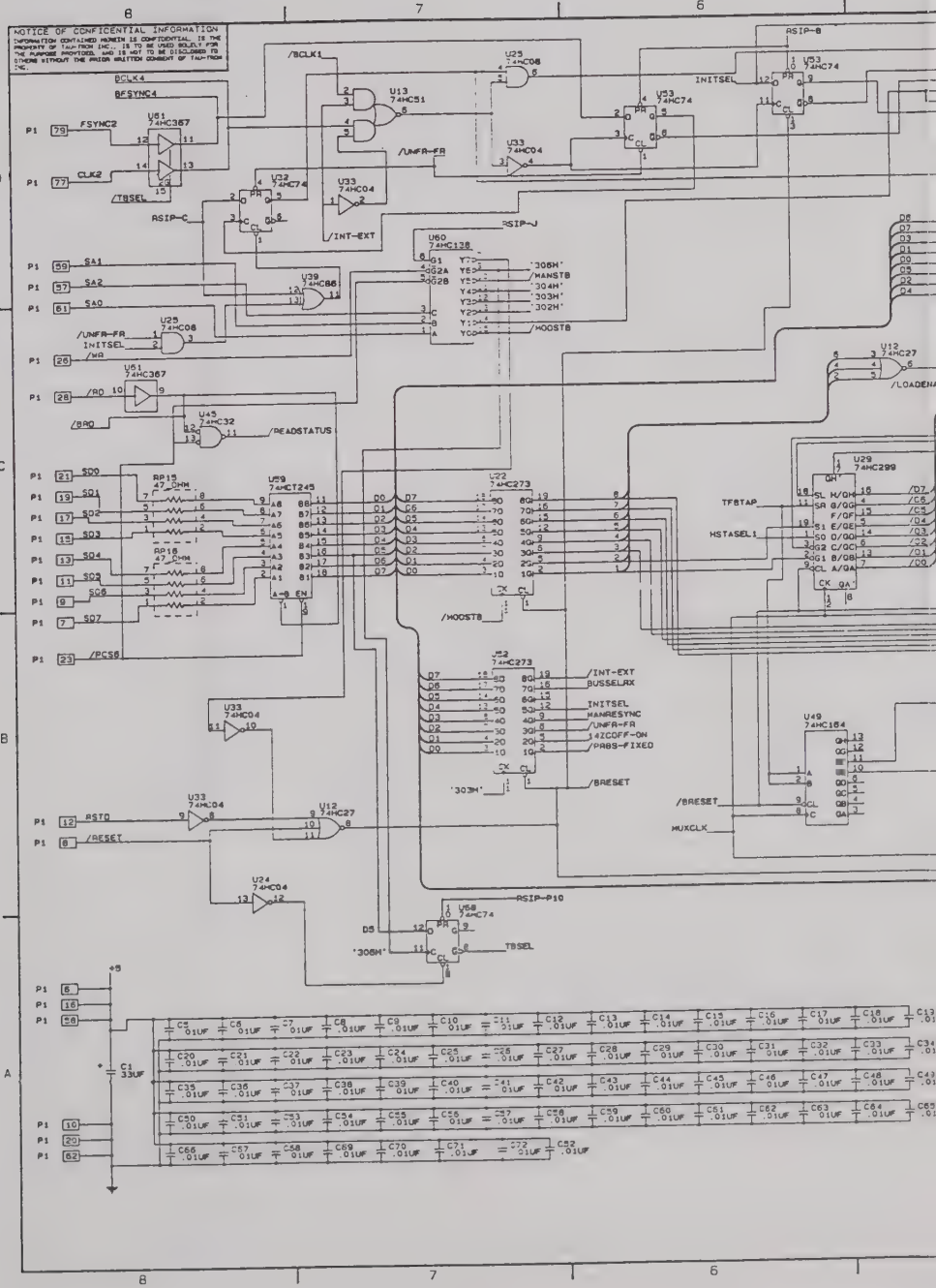
TAU-TRON
A UNIT OF GENERAL SIGNAL

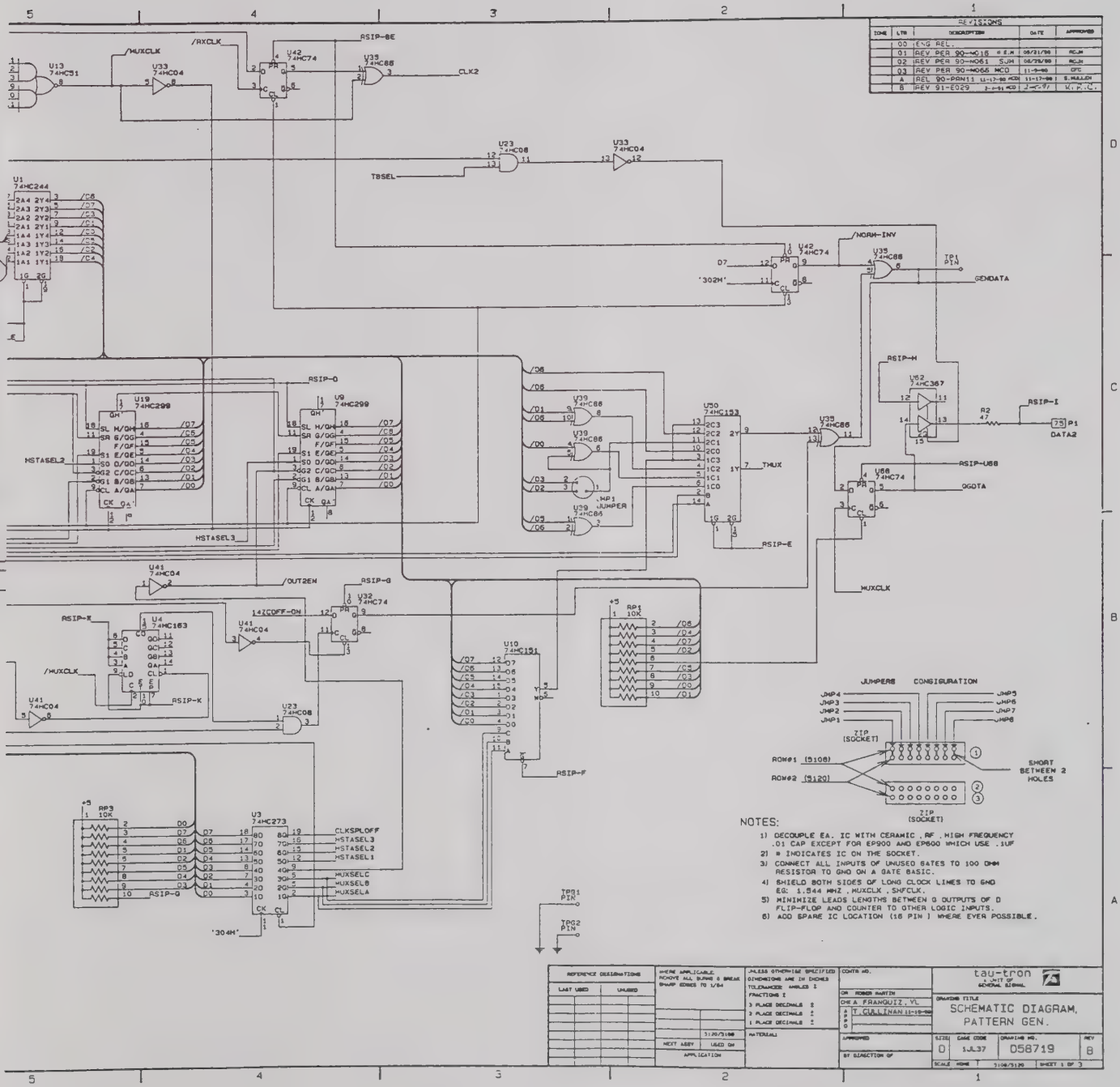
DRAWING TITLE
ASSEMBLY DRAWING
5120/5108 PATTERN GEN.

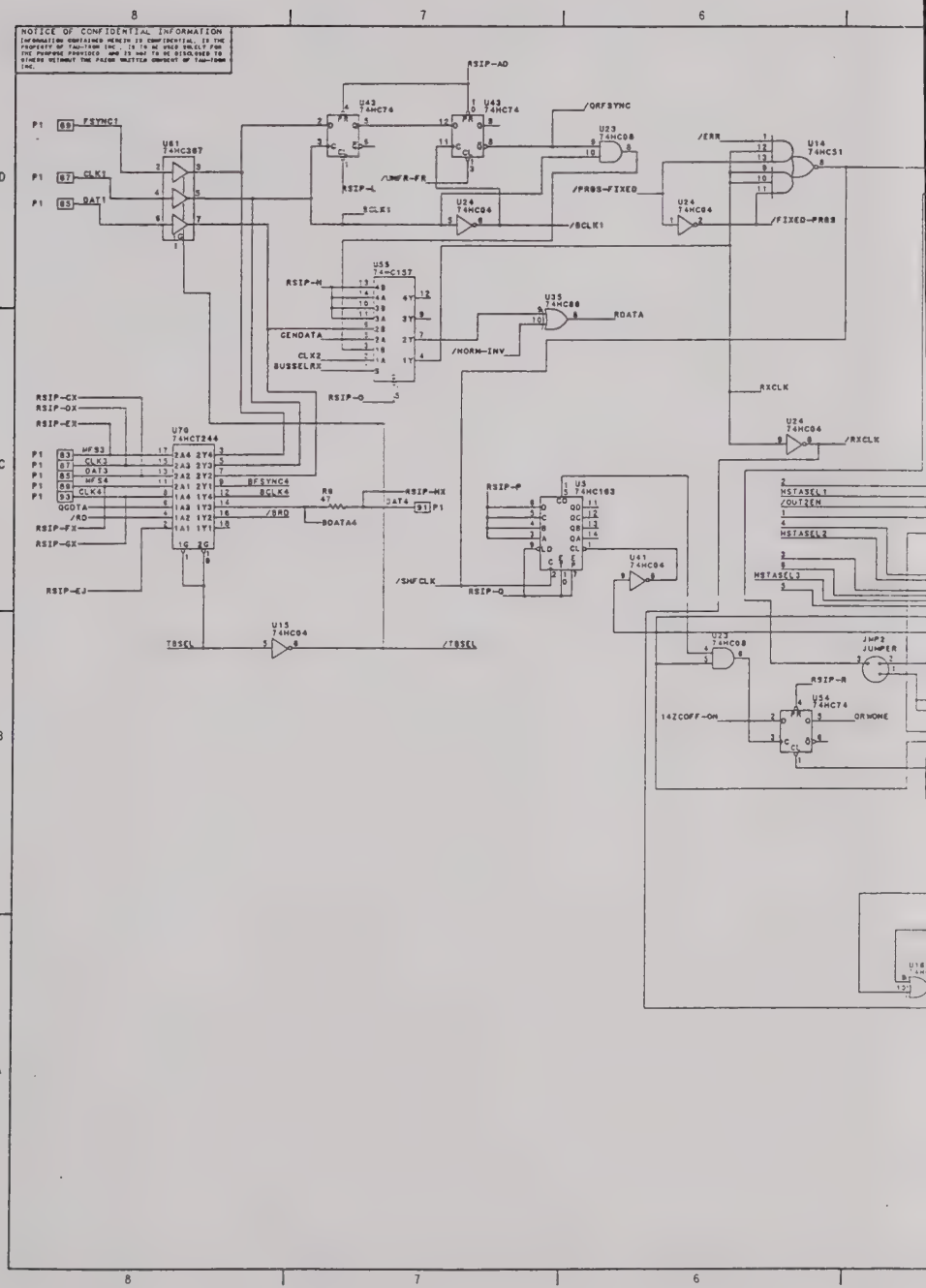
SIZE	CAGE CODE:	DRAWING NO.	REV
D	1JL37	D58721	A1

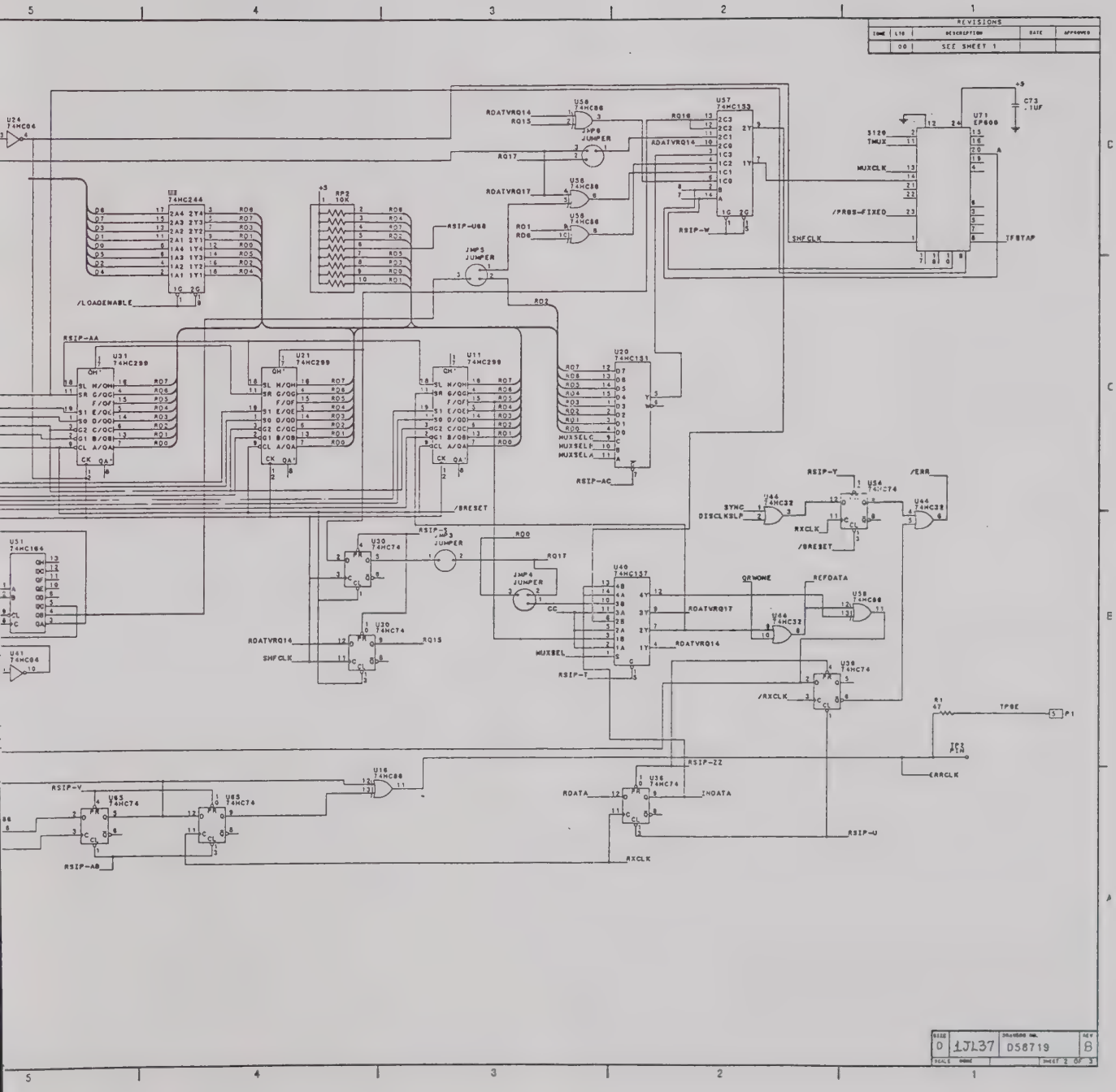
SCALE 1:1 PROJECT 5120/08 SHEET 1 OF 1

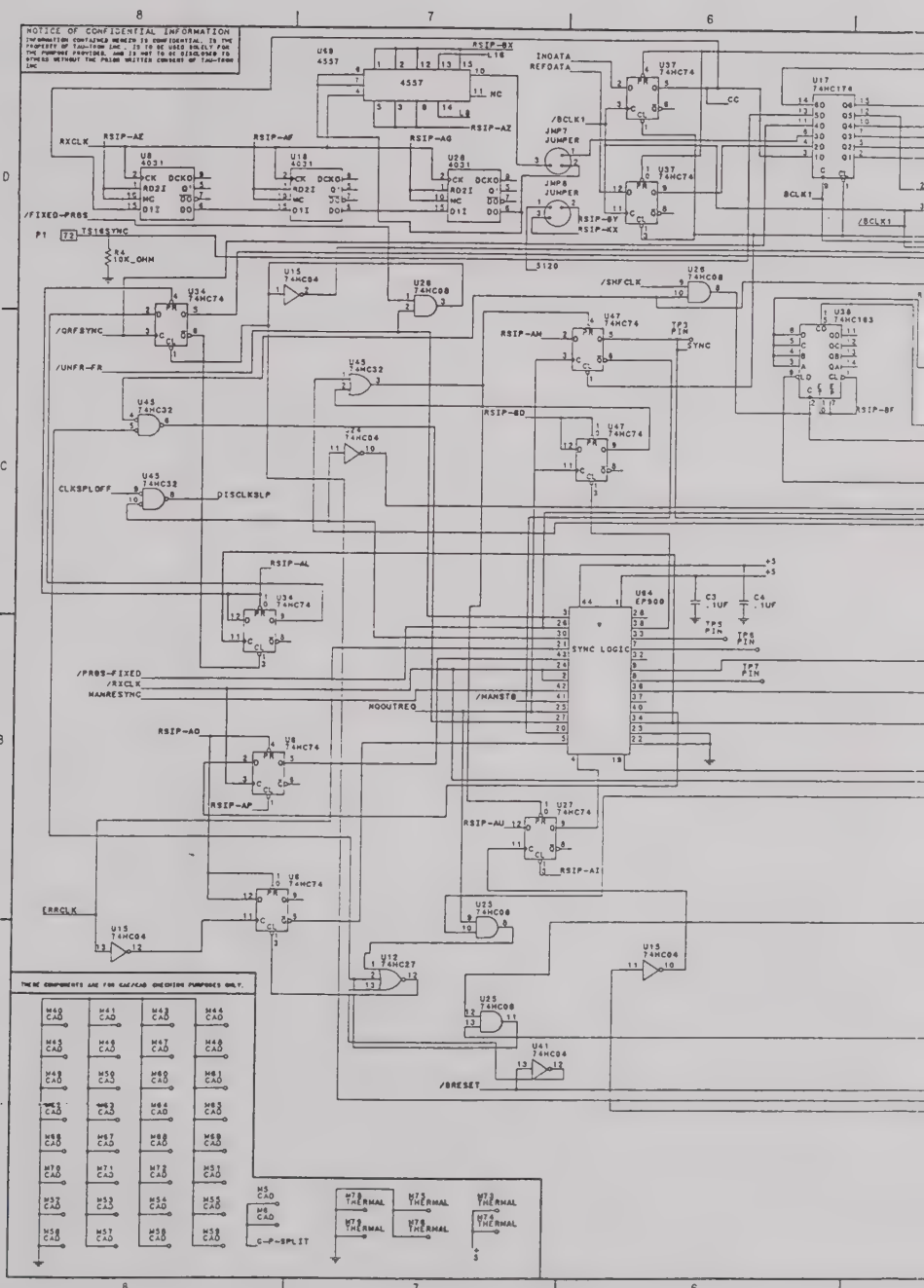
4 3 2 1


NOTICE OF CONFICENTIAL INFORMATION
/BCLK1
BCLK4
BFSYNC4
FSYNC2
CLK2
/TBSEL
/UNFR-FR
/INT-EXT
RSIP-C
RSIP-J
RSIP-8
INITSEL
/WR
/RD
/RDSTATUS
SA1
SA2
SA0
SD0
SD1
SD2
SD3
SD4
SD5
SD6
SD7
/PCS6
/WOOSTB
'306M'
/MANSTB
'304M'
'303M'
'302M'
/LOADENA
TFBTAP
HSTASEL1
/INT-EXT
BUSSELRX
MANRESYNC
14ZCOFF-ON
PABS-FIXED
/BRESET
MUXCLK
RSTO
/RESET
RSIP-P10
TBSEL
+5
C1 33UF


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED
00 ENG REL.
01 REV PER 90-M016 # E.M 08/21/90 RCJH
02 REV PER 90-M061 S.JH 06/25/90 RCJH
03 REV PER 90-M066 MCO 11-2-90 CPC
A REL 90-P0N11 11-17-90 MCO 11-17-90 S.MULLEN
B REV 91-E029 2-6-91 MCO 2-6-91 W.P.C.
/RXCLK
/MUXCLK
ASIP-8E
CLK2
T8SEL
/NORM-INV
D7
'302H'
GENDATA
RSIP-H
RSIP-I
DATA2
RSIP-U68
QGOTA
RSIP-0
HSTASEL2
HSTASEL3
TMUX
RSIP-E
MUXCLK
/OUT2EN
RSIP-G
14/COFF-ON
RSIP-K
RSIP-F
JUMPERS CONFIGURATION
JMP4
JMP3
JMP2
JMP1
JMP5
JMP6
JMP7
JMP8
ZIP (SOCKET)
ROW#1 (5108)
ROW#2 (5120)
SHORT BETWEEN 2 HOLES
NOTES:
1) DECOUPLE EA. IC WITH CERAMIC, RF, HIGH FREQUENCY .01 CAP EXCEPT FOR EP900 AND EP600 WHICH USE .1UF
2) # INDICATES IC ON THE SOCKET.
3) CONNECT ALL INPUTS OF UNUSED GATES TO 100 OHM RESISTOR TO GND ON A GATE BASIC.
4) SHIELD BOTH SIDES OF LONG CLOCK LINES TO GND EG: 1.544 MHZ, MUXCLK, SHFCLK.
5) MINIMIZE LEADS LENGTHS BETWEEN Q OUTPUTS OF D FLIP-FLOP AND COUNTER TO OTHER LOGIC INPUTS.
6) ADD SPARE IC LOCATION (16 PIN) WHERE EVER POSSIBLE.
'304H'
CLKSPLOFF
HSTASEL3
HSTASEL2
HSTASEL1
MUXSELC
MUXSELB
MUXSELA
TP81 PIN
TP82 PIN
REFERENCE DESIGNATIONS
LAST USED | UNUSED
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ±
FRACTIONS ±
3 PLACE DECIMALS ±
2 PLACE DECIMALS ±
1 PLACE DECIMAL ±
MATERIAL
APPROVED
DRAWN BY ROGER MARTIN
CHK'D FRANQUIZ, YL
APPD T. CULLINAN 11-19-90
BY DIRECTION OF
tau-tron
A UNIT OF GENERAL SIGNAL
DRAWING TITLE
SCHEMATIC DIAGRAM, PATTERN GEN.
SIZE D
CAGE CODE 5JL37
DRAWING NO. 058719
REV B
SCALE NONE
SHEET 1 OF 3


NOTICE OF CONFIDENTIAL INFORMATION
RSIP-AD
U43 74HC74
/QRFSYNC
U23 74HC08
/ERR
U14 74HC51
P1 89 FSYNC1
P1 87 CLK1
P1 85 DAT1
U61 74HC367
/INFR-FR
RSIP-L
SCLK1
U24 74HC04
/SCLK1
/PROG-FIXED
/FIXED-PROG
U55 74HC137
RSIP-M
GENDATA
CLK2
BUSSELRX
RSIP-O
U35 74HC08
RDATA
/NORM-INV
RXCLK
RSIP-CX
RSIP-OX
RSIP-EX
U70 74HCT244
P1 83 WFS3
P1 87 CLK3
P1 85 DAT3
P1 80 WFS4
P1 93 CLK4
QGDTA
/RD
RSIP-FX
RSIP-GX
RSIP-EJ
BFSYNC4
BCLK4
/BRD
R9 47
BDATA4
RSIP-MX
DAT4
P1 91
RSIP-P
U3 74HC163
/SNFCLK
U61 74HC04
T8SEL
U13 74HC04
/T8SEL
MSTASEL1
/OUTZEM
MSTASEL2
MSTASEL3
JMP2 JUMPER
RSIP-R
U54 74HC74
14ZCOFF-ON
ORWONE
8
7
6
D
C
B
A


REVISIONS
SEE SHEET 1
U24 74HC04
U8 74HC244
RP2 10K
U58 74HC86
U57 74HC153
U71 EP600
C73 .1UF
JMP8 JUMPER
JMP5 JUMPER
JMP3 JUMPER
JMP6 JUMPER
RSIP-U58
RSIP-W
RSIP-AA
RSIP-AC
RSIP-Y
RSIP-T
RSIP-ZZ
RSIP-U
RSIP-AB
/LOADENABLE
/BRESET
/PROG-FIXED
TFBTAP
MUXCLK
SHFCLK
RXCLK
/RXCLK
/ERRCLK
/ERR
SYNC
DISCLKSLP
QRWONE
REFDATA
RDATA
INDATA
TP8E
U31 74HC299
U21 74HC299
U11 74HC299
U20 74HC151
U40 74HC157
U30 74HC74
U44 74HC32
U54 74HC74
U63 74HC74
U65 74HC74
U36 74HC74
U16 74HC86
U31 74HC164
U41 74HC04
SIZE D
DRAWING NO. D58719
REV B
SCALE none
SHEET 2 OF 3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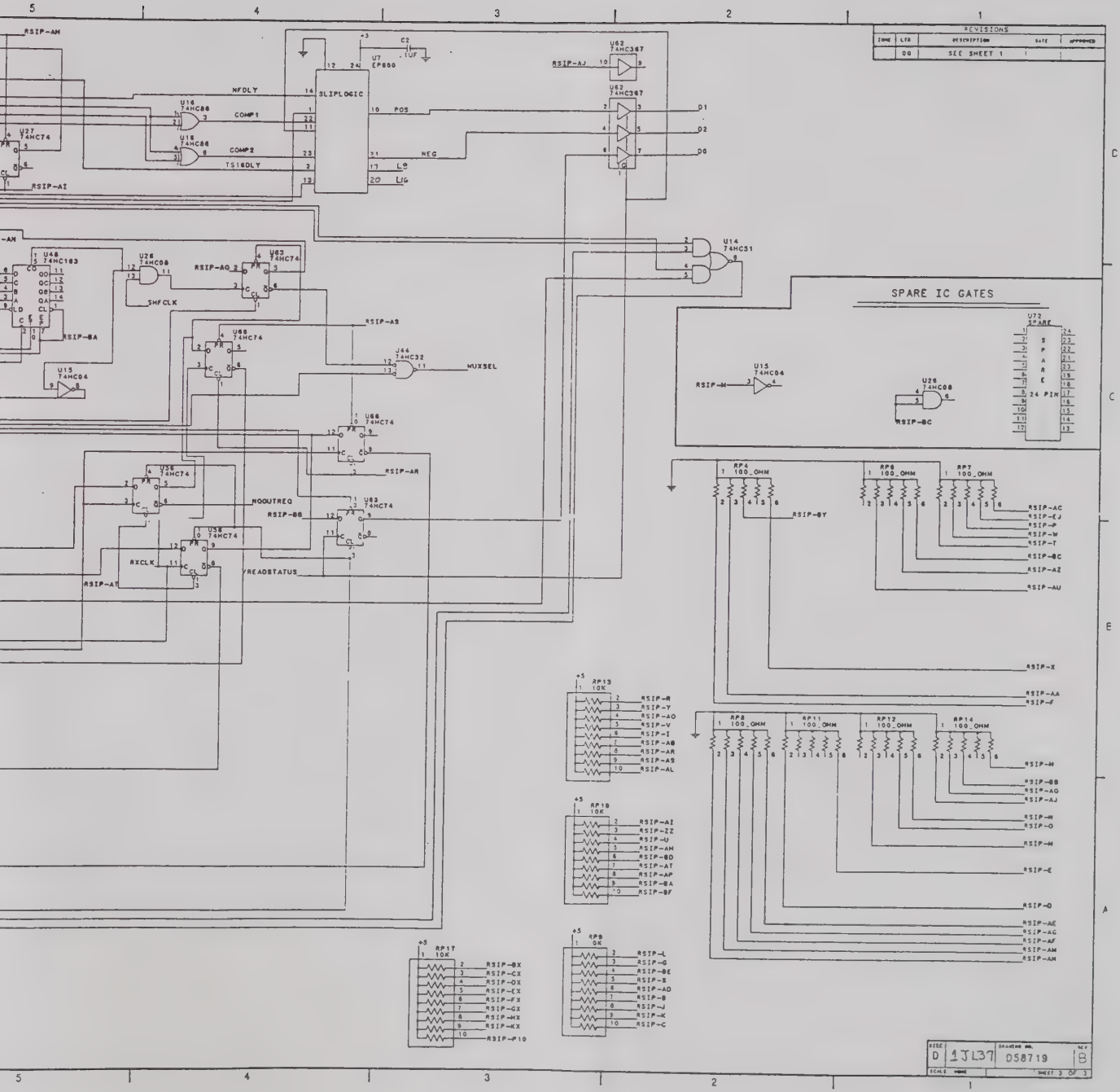
RXCLK
/FIXED-PRBS
P1
TS16SYNC
R4 10K_OHM
/QRFSYNC
/UNFR-FR
CLKSPLOFF
DISCLKSLP
/PRBS-FIXED
/RXCLK
MANRESYNC
ERRCLK
/SHFCLK
/BCLK1
INDATA
REFDATA
JMP7 JUMPER
JMP8 JUMPER
RSIP-AE
RSIP-AF
RSIP-AG
RSIP-AH
RSIP-AI
RSIP-AL
RSIP-AM
RSIP-AO
RSIP-AP
RSIP-AU
RSIP-AZ
RSIP-BD
RSIP-BF
RSIP-BY
RSIP-BX
SYNC LOGIC
/MANSTB
NGOUTREQ
/BRESET
THERMAL
C-P-SPLIT
TP5 PIN
TP6 PIN
TP7 PIN
TP3 PIN
SYNC
3120
THESE COMPONENTS ARE FOR CAE/CAD CHECKING PURPOSES ONLY.


REVISIONS
SEE SHEET 1
SLIPLOGIC
WFDLY
COMP1
COMP2
TS16DLY
POS
NEG
SHFCLK
MUXSEL
MODUTREQ
RXCLK
SPARE IC GATES
SPARE
24 PIN
RSIP-AM
RSIP-AI
RSIP-AJ
RSIP-AQ
RSIP-AS
RSIP-AR
RSIP-BB
RSIP-AT
RSIP-BA
RSIP-M
RSIP-BC
RSIP-BY
RSIP-AC
RSIP-EJ
RSIP-P
RSIP-W
RSIP-Y
RSIP-AZ
RSIP-AU
RSIP-X
RSIP-AA
RSIP-F
RSIP-AO
RSIP-V
RSIP-I
RSIP-AB
RSIP-AL
RSIP-ZZ
RSIP-U
RSIP-AH
RSIP-BD
RSIP-AP
RSIP-BF
RSIP-N
RSIP-O
RSIP-E
RSIP-AE
RSIP-AG
RSIP-AF
RSIP-AK
RSIP-BX
RSIP-CX
RSIP-OX
RSIP-EX
RSIP-FX
RSIP-GX
RSIP-HX
RSIP-KX
RSIP-P10
RSIP-L
RSIP-G
RSIP-BE
RSIP-R
RSIP-AD
RSIP-B
RSIP-J
RSIP-K
RSIP-C
D1
D2
D0
D
1JL37
D58719
SHEET 3 OF 3

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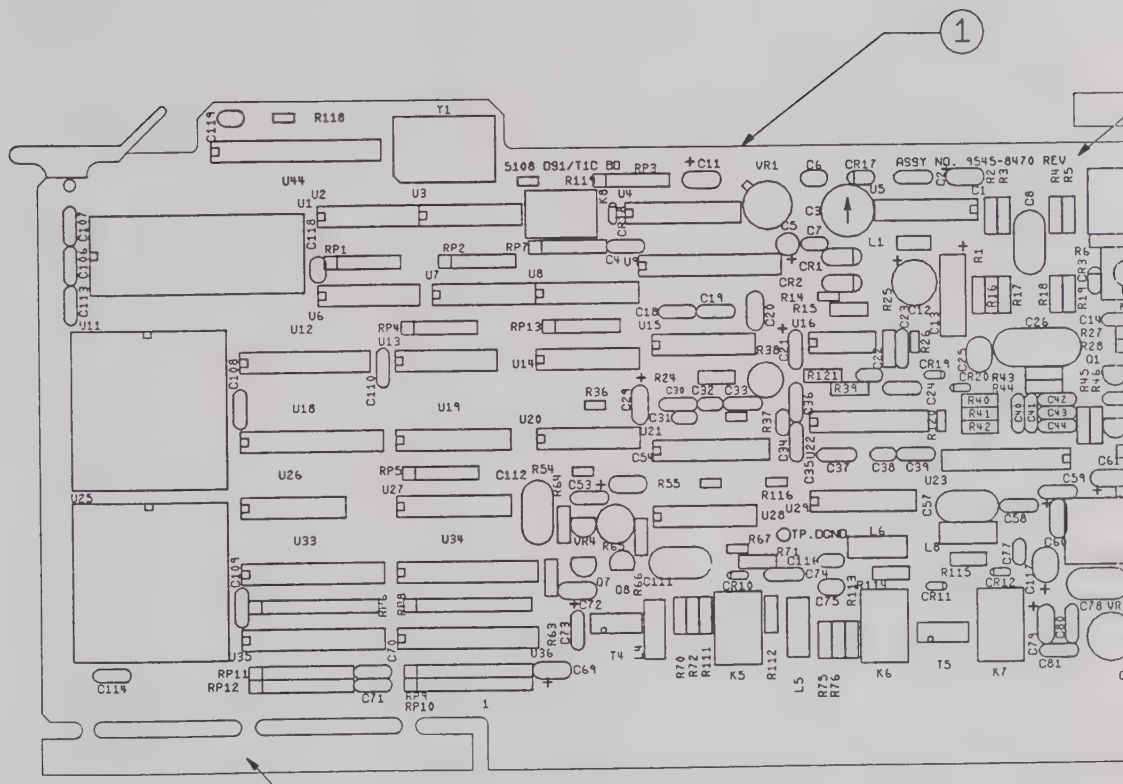
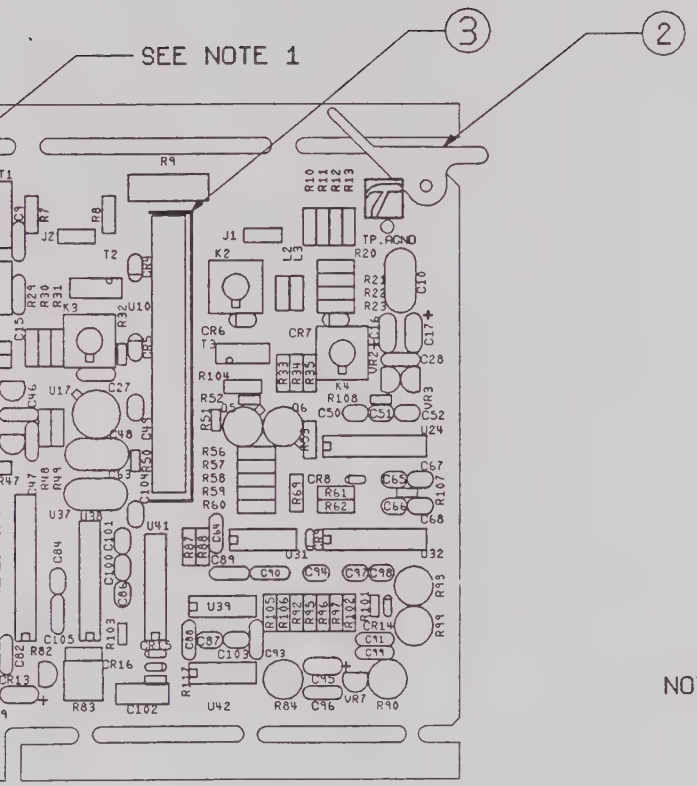


REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REL PER ECO# 89-E053 MCW 4/26/89	4/28	MD



NOTES:

1. PLACE THE ASSEMBLY PARTS LIST REVISION MARK ON THE ASSEMBLY IN THE DESIGNATED AREA.
2. CORNER PIECES TO BE REMOVED AFTER WAVESOLDER.

WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES : FRACTIONS : 3 PLACE DECIMALS : 2 PLACE DECIMALS : 1 PLACE DECIMALS :	CONTR NO.	TAU-TRON A UNIT OF GENERAL SIGNAL		
		DR MARTHA SPINDLER 2/1/89	DRAWING TITLE	ASSEMBLY DS1/T1C BD	
		CHK			
		APPD Alberto Tarango 2/3/89			
5108	MATERIAL:	APPROVED	SIZE D	CODE IDENT NO.	DRAWING NO. 58470 REV A
NEXT ASSY / USED ON		BY DIRECTION OF	SCALE 1.5/1	5108	SHEET 1 OF 1
APPLICATION					

58470

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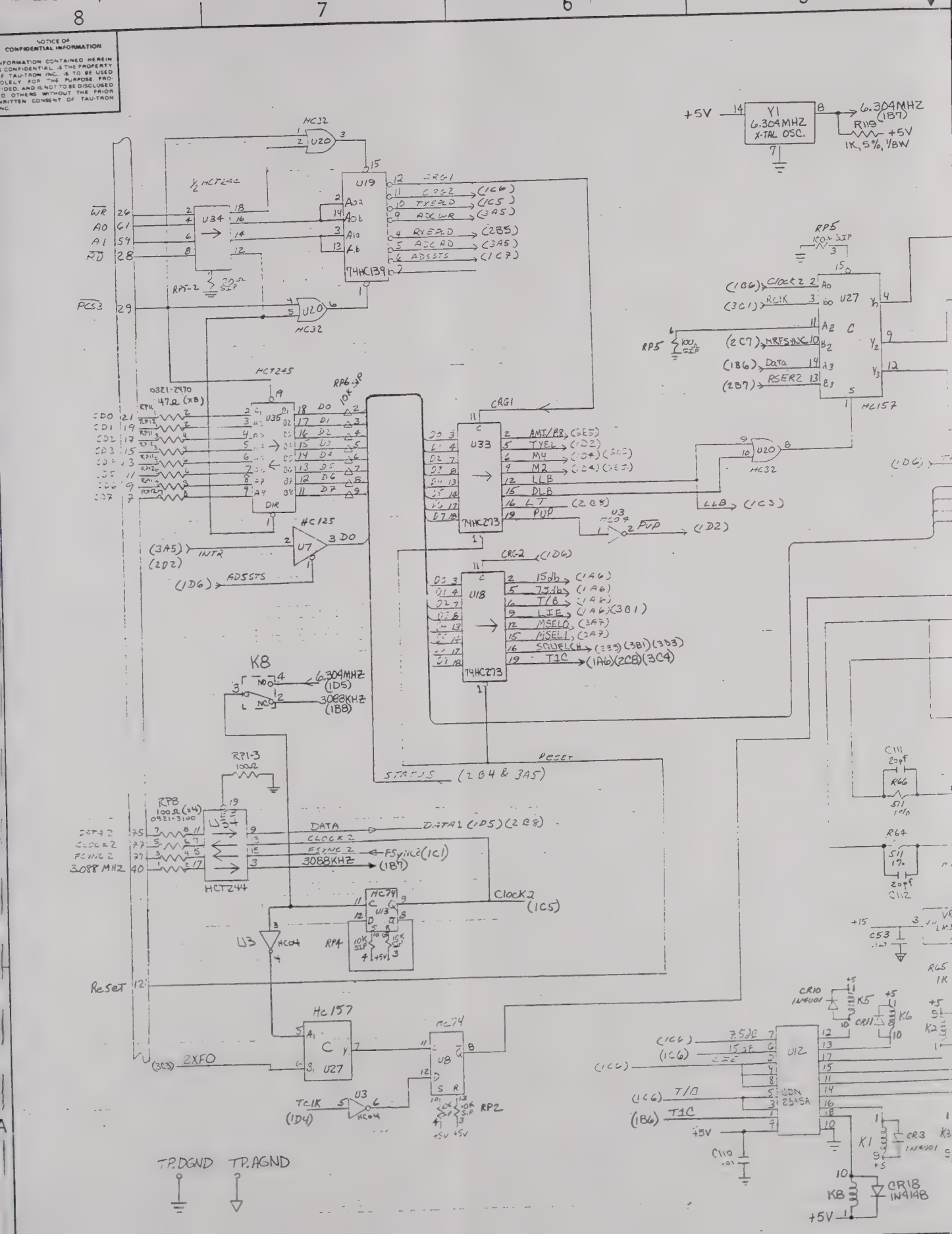
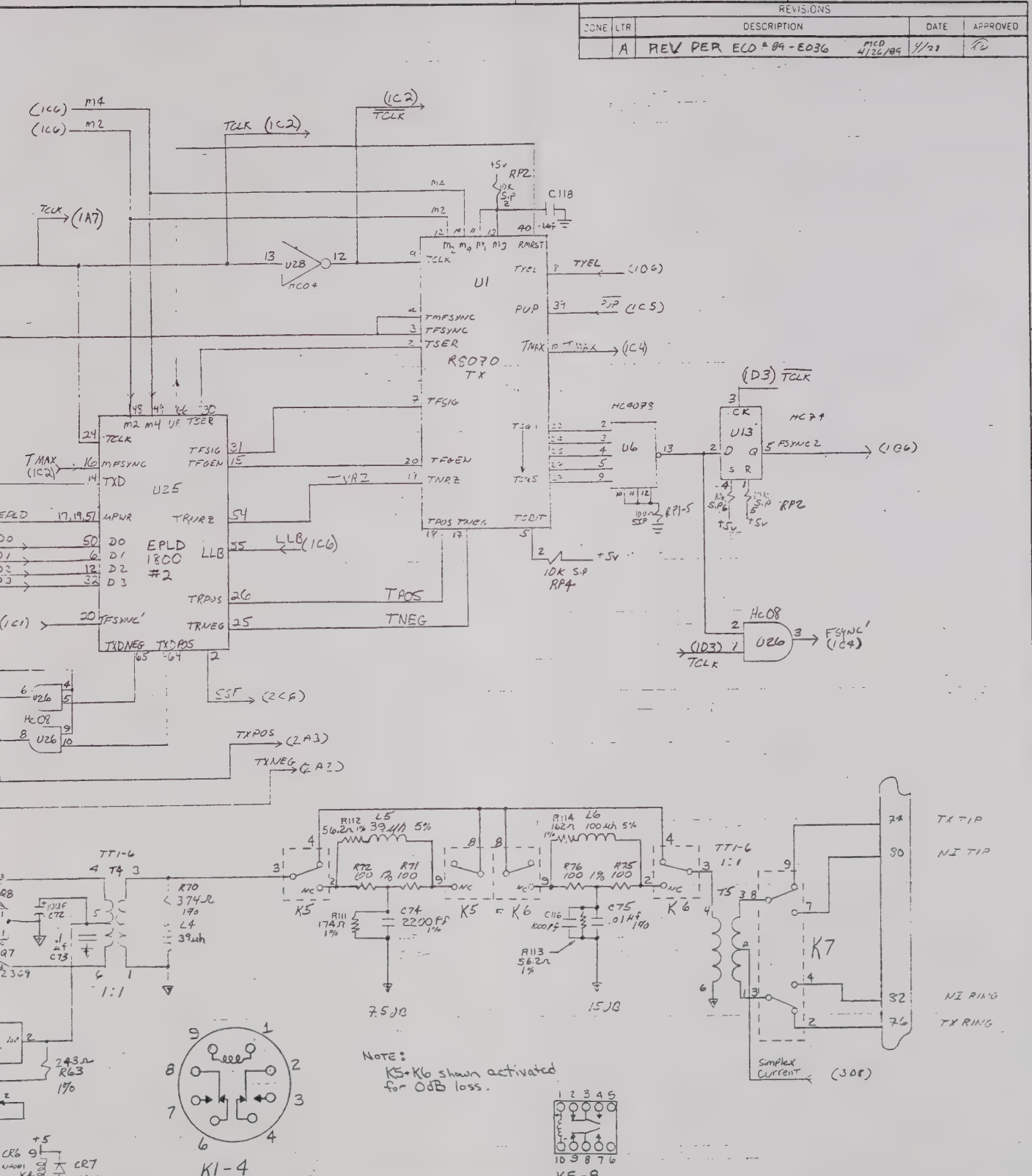


REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REV PER ECO # 89-E036 MCD 4/26/89	4/27	


U1
RS070
TX
U25
EPLD
1800
#2
U6
U13
HC4073
HC74
HC08
U26
RP1-5
RP2
RP4
10K S.I.P
TMAX
(IC2)
TCLK
TFSIG
TFGEN
TNRZ
TXD
TRNRZ
LLB
TPOS
TNEG
TXPOS
TXNEG
FSYNC'
FSYNC 2
TYEL
PUP
TMFSYNC
TFSYNC
TSER
RMRST
LPWR
TRPOS
TRNEG
TXDNEG
TXDPOS
SSF
(IC1)
(IC2)
(IC3)
(IC4)
(IC5)
(IC6)
(IA7)
(IC6)
(IC6)
(IC6

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92
94
96
98

RX Analog GND

+5V
C119 .1
3msOUT → (2C4)

(2B5) RPOS 18
(2B5) RNEG 19
(2B5) RXEPLD 23
(1B6) T1C 14
(2C4) DS1EXZ 21
22

U44 T1C EPLD

24 5 2 9 1 11 13 17 20 12

DØ (2C3)

R118 10K, 5%, 1/8W
+5V
3ms (2C3)

U44 PINS 1,13,17,20 CONNECTED TO DGND VIA CIRCUIT SIDE ETCH

HC32
U14
10 9 8

+5V
C106 .01
C107 .01
HC4078
U2

P/O U1
8070 RX

RSQ 1 → RSQ 5
ESF (1C3) 57 YEL MD
RYEL 61
RRED 32 → (2C8)
RSER 30
RSER
RVLL 28
ERR 29
RS BIT 31 → (2C8)
RSYNC 37
56 RCLK
54 55

RCLK (2C3)
(2B8) ← RSYNC
12 HCC4 U3 13

(2B7) RCRC

RCLK 11
(3C1) RCLK

(2D5) RXBIT 43
(2D5) RXCLK 58
(2B5) RFSYNC 7
(2C3) FSYNC 21
(2B5) RNEG 60
(2B5) RPOS 59
(2C5) 22
67
RSER (2C4) 8
13
(1B7) DATA 23
(1C6) LT 57

½ IC
U25
EP 1200J #2

FE 77 39
RMFSYNC 68 RMFSYNC (2C3)
RSBITOUT 40 RSBITOUT (2C5)
AMIB8 56
RSER2 34 RSER2 (1C5)
RSER1 4 RSER1 (2C3)
CRCER 3 D7 CRCER (2B4)
5
45
LIPFD 53
MRFSYNC 37 MRFSYNC (1C5)

(1C6)
AMI/B8
(2B8) 6 CRCE 25

(2C8)
(3C-1) RNEG
(3C-1) RPOS
(2C8)
(1C6)
(2C8)

+15V 1 +5V
AGND 4 C54 .47µF C71 .1µF
AGND 3 C83 .47µF C81 .1µF
-15V 2 -15V

= Analog Tx GND
} These are connected at connector only.
= Analog Rx GND

+5V 8
+5V 16
+5V 53
C69 33µF C70 .1µF
DGND 10
DGND 20
DGND 62

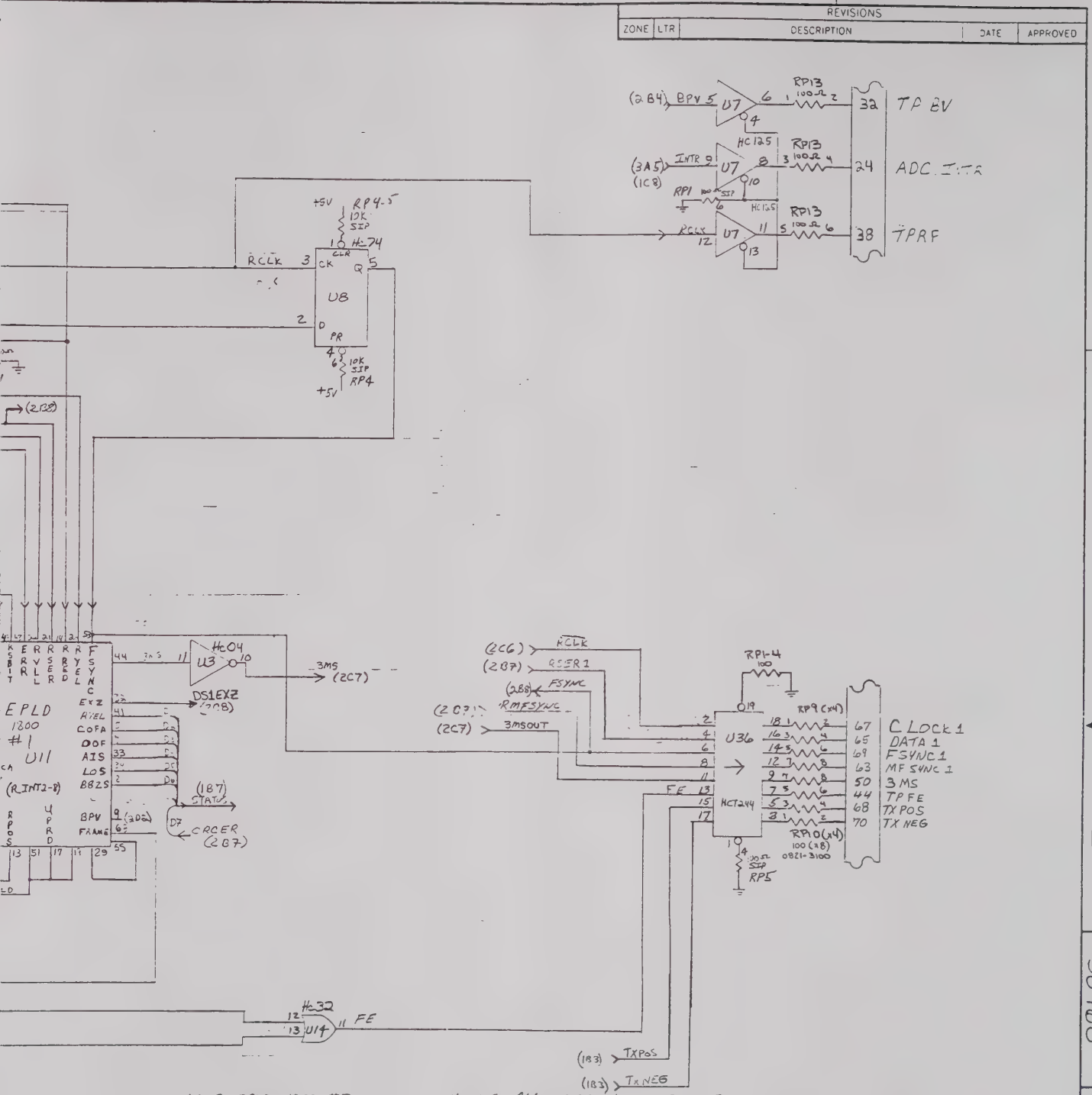
= DIGITAL GND

NOTE1 :R8070 CONNECTION OF UNSED PINS

PIN	CONN.
6	DIGITAL GND
15	
16,62	
32	
52	
53	
58	
59	
60	
61	
63	
33	
1	+5V
64,41	

NOTE2: EPL
Pins To be
1
35 56
Pins to
18
52

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



800 #1
rounded (0G)

Note 3: EPLD 1800 #2
Pins To be Grounded (0G)
1
35, 36, 61

Pins To +5V
18
52

Note 4: ALL UNUSED HCMOS DEVICE INPUTS MUST BE TIED LOW.

Note 5: Δ DENOTES 10K RES TO +5V

Note 6: T1CEPLD
NO CONNECT PINS: 3, 4, 6, 7, 8, 10, 15, 16
DGND PINS: 1, 12, 13, 17, 20
+5V PIN: 24

FERENCE DESIGNATIONS			
1ST USED		UNUSED	
44	L8	LY40	U30
21	RP13	VR6	U43
119	Q8	C55,56,76,85,92	
20	T5	R86,87,X,77-80,	
2	VR7	85,86,89,91,93,	
8	Y1	94,100,109,110	

WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64

58470	5108
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ± ~
FRACTIONS ± ~
3 PLACE DECIMALS ± ~
2 PLACE DECIMALS ± ~
1 PLACE DECIMALS ± ~
MATERIAL:

CONTR NO.

DR	M.L. Tremblay	1/19/87
CHK		
APPD		

APPROVED
BY DIRECTION OF

tau-tron
A UNIT OF GENERAL SIGNAL

DRAWING TITLE
SCHEMATIC
DS1/T1C

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		58468	A
SCALE	5108	SHEET 2 OF 3	

58468

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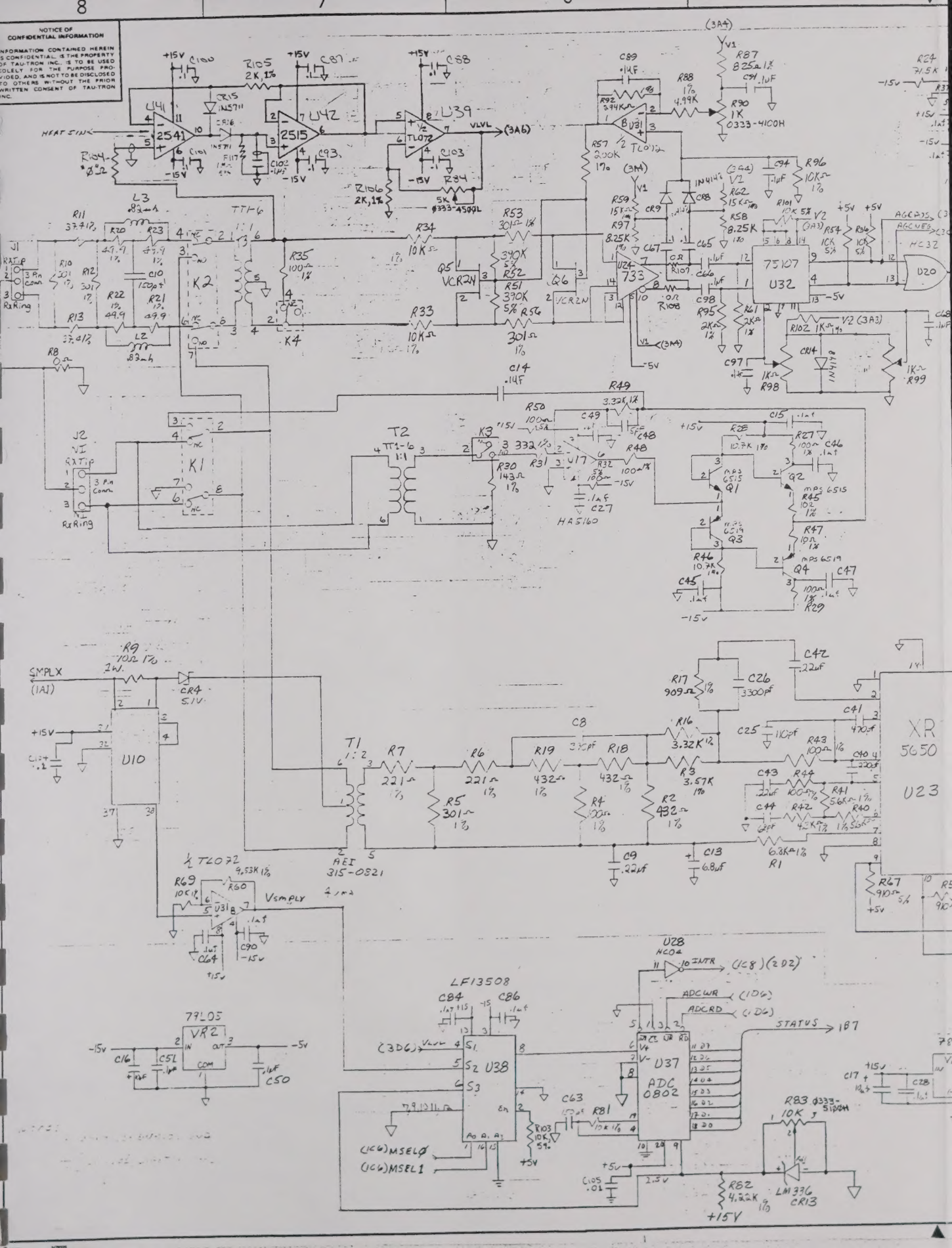
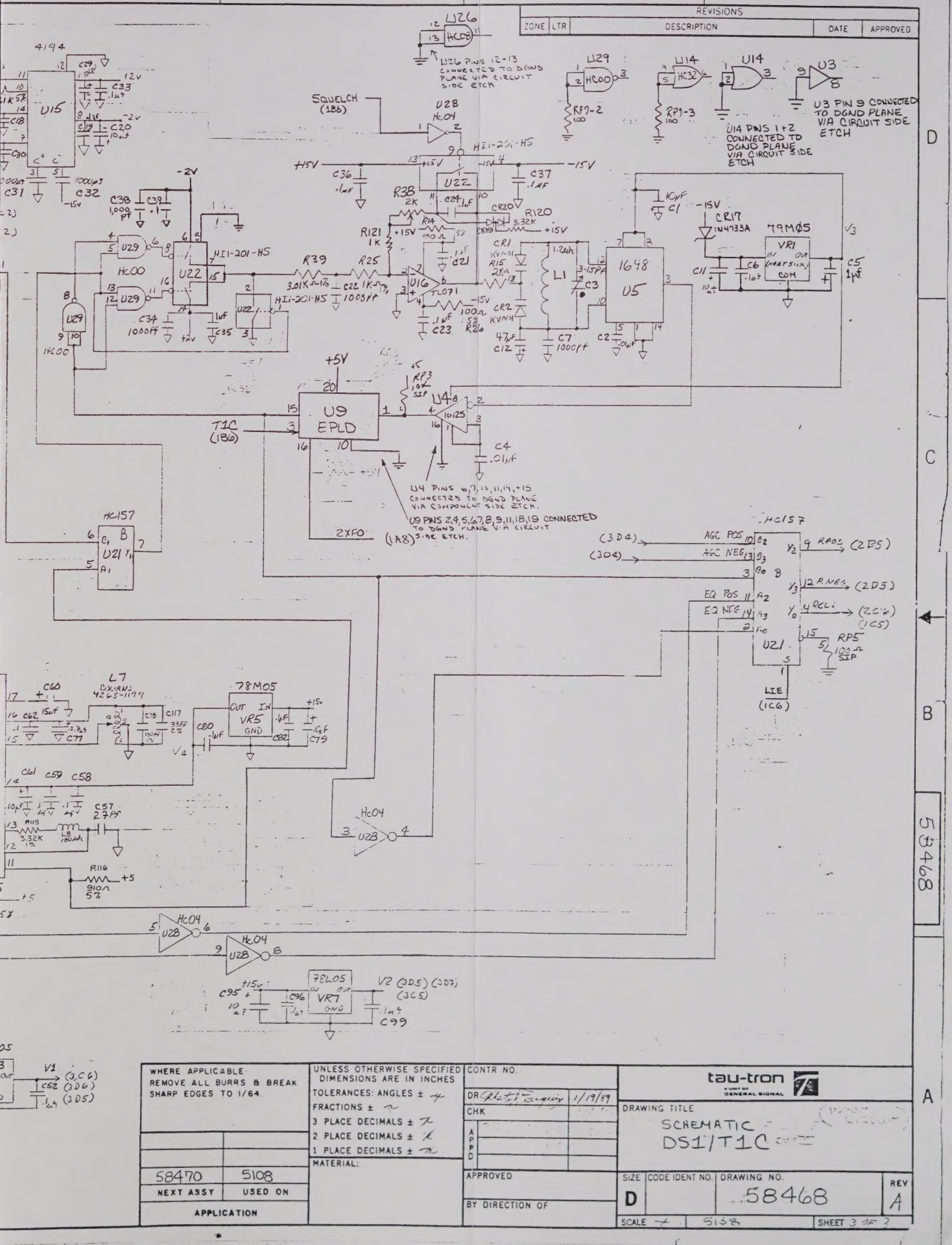




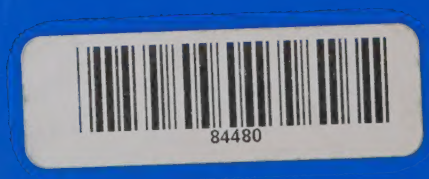
WHERE APPLICABLE REMOVE ALL BURRS & BREAK SHARP EDGES TO 1/64	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 1° FRACTIONS ± 1/32 3 PLACE DECIMALS ± .005 2 PLACE DECIMALS ± .01 1 PLACE DECIMALS ± .1 MATERIAL:	CONTR NO.	tau-tron A UNIT OF GENERAL SIGNAL		
		DR [illegible] 1/19/89	DRAWING TITLE	SCHEMATIC DS1/T1C	
		CHK			
		APPD			
58470 / 5108		APPROVED	SIZE D	CODE IDENT NO.	DRAWING NO. 58468 REV A
NEXT ASSY / USED ON		BY DIRECTION OF	SCALE 1/1	5108	SHEET 3 OF 7
APPLICATION					

58468

Document Title: Product Manuals	Document Number: ESC-2356-93-01
Revision Number: A_ B_ C_ D_ E_	Page: N/A
Prepared By: Rick Schultz	Approved By:
Issued By: Jim Steinau	Issue Date: 10/19/93

CHANGE NOTICE SUMMARY

Revision	Reason for Change	Date of Change



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Telex 750245 (1-800-TAU-TRON (1-800-828-8766), outside MA) FAX 508-692-1938